THE ARCHEOLOGY OF EXHAUSTED CAVE:

A STUDY OF PREHISTORIC CULTURAL ECOLOGY ON THE COCONINO NATIONAL FOREST, ARIZONA

By

Bruce R. Hudgens

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ACKNOWLEDGMENTS

To my many friends who have contributed their assistance and advice toward the fulfillment of this project, I am deeply indebted.

My gratitude goes to the Coconino National Forest for extending permission to conduct this research program on government lands and to the Museum of Northern Arizona under whose permit this study was conducted. I wish also to thank the staffs of Montezuma Castle National Monument and Tuzigoot National Monument for allowing me to study their artifact collections and borrow from their research libraries.

Several persons assisted during the 1970-1971 field session. Dr. J. Richard Ambler's guidance throughout the excavation period was most helpful. Other individuals who gave willingly of their time and shared in the long hours of extracting dirt, artifacts, and ecofacts from the cave include: Helen Hudgens, John Gooding, Margie Gooding, Lowell Page, Charles James, John Kraus, Dr. Joseph Feathers, Nancy Veronda, Melanie Brisco, Tony Perpich, Dan Reiley, Dr. Robert Gallagher, Marsha Gallagher, Tom Wallace, Cherie Breuss, Peggy Buffo, Steve Bell, Terry Pike, Sharon Pike, Larry Armstrong, Jerry Olaff, Don Huff, and Claudia Simmons.

The task of identifying and classifying biotic artifactual materials was, for the most part, carried out by specialists. Dr. Richard Hevly performed macroscopic identifications of plant artifacts. Artifactual mammalian remains were identified by George Ruffner, Kent Van de Graff, and Dr. Gary Bateman. Feather identifications were made by Dr. Lyndon Hargrave. Dr. Dale Nations identified the marine and fresh water shell specimens. Most mineral identifications were made either by Dr. Dale Nations or Mr. William Breed.

The staff at the Museum of Northern Arizona aided in classifying and recording artifactual materials. My thanks go out to Ann Hitchcock and Marsha Gallagher in particular for their extra efforts to assure proper record keeping and to simplify the manner in which records were kept.

Artifactual photographs contained in this report are through the courtesy of Marc Gaede, who generously gave of his time and talents.

Phyllis Warner spent many hours typing and editing this manuscript.

I am especially grateful to my thesis committee members who have imparted beneficial knowledge and constructive criticism throughout this study. Dr. J. Richard Ambler has provided his special insight concerning cave excavations. His experience in working with prehistoric Southwestern cultures was beneficial to the analysis and interpretation of this work. Dr. John Wood's knowledge of theoretical concepts and interpretive logic helped to order this work. Dr. Richard Hevly contributed his particular interests and skills toward integrating archeological concepts with biological concepts.

My wife, Helen, and son, Brian, deserve my final acknowledgment for their patience and for the loving help they have given me.

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ABSTRACT

Exhausted Cave is a component of the Clear Creek Ruins, which is a Southern Sinagua site located in the Verde Valley, Arizona.

The cave was apparently utilized between A. D. 1130 and 1320 by the inhabitants of the Clear Creek Ruins. Artifactual evidence of subsistence and maintenance activities suggests intermittent use of the cave from A. D. 1130 to 1275 or 1300 for shelter and storage purposes while carrying on mining operations locally. Between A. D. 1275 or 1300 and 1320, the cave appears to have been occupied by a flint knapping specialist who may have also been the owner of an extraordinary ceremonial medicine bundle. There are additional indications of craft and subsistence specializations at the Clear Creek Ruins, which suggest a complex redistribution type of economy.

Trade goods found in the cave indicate strong economic affiliations with groups living in the central Little Colorado region. This relationship, which lasted the duration of the cave's utilization period, is characterized by a unique Little Colorado ceramic tradition which developed in that region when a cultural frontier separating the Kayenta Anasazi and Sinagua from the Mogollon-Cibola Anasazi collapsed at about A. D. 1070.

These economic relationships between the cave's occupants and their natural and cultural environments suggest that several past theories concerning the Sinagua should perhaps be looked upon a little more critically and that there is a need for increasing research activities in this part of the state in order to better understand the complex nature of interrelationships between the various southwestern archeological regions.

INTRODUCTION

Centrally located among Arizona's prehistoric Mogollon, Anasazi, and Hohokam cultures is a group of puebloans known as the Sinagua. Two divisions of the Sinagua culture are recognized (Colton 1946). A northern expression of the Sinagua culture occurs on the Colorado Plateau south of the Little Colorado River extending eastward from the San Francisco Mountains to Chevelon Creek just east of Winslow, Arizona. The Southern Sinagua culture occupies the Verde Valley along eastern tributaries of the Verde River. Exhausted Cave is located on West Clear Creek within the Southern Sinagua culture area (Fig. 1).

Archeological investigations have been carried out sporadically in the Verde Valley over a long period of time. Research endeavors have focused primarily on locating and recording caves, cliff dwellings, and large pueblo ruins. Less than two dozen archeological sites have been professionally excavated in the Verde area, and some of these have not yet been reported on. A majority of the excavated sites are either early pit house villages or late pueblo ruins. Cave sites have, for the most part, been neglected by the professionals but, unfortunately, not by the relic collectors.

Investigations in this area have come about mainly as a result of salvage operations and very few sites have been approached as research problem-oriented studies. There are a few good overall site descriptions and syntheses of culture history which have resulted from previous work in the Verde, but virtually nothing is known concerning the interrelationships of the Southern Sinagua culture to other archeological cultures or to its own natural environment.

The presence of foreign elements in archeological sites would seem a good indication that cultures interrelate with one another at least often enough to exchange goods with one another. The particular geographical location of the Sinagua suggests that they were in continuous interaction with a variety of other cultures throughout their history. It would seem, therefore, that a study of Sinagua interrelations with their neighbors could be particularly informative.

The scope of this report is to determine economic aspects of the culture of the occupants of Exhausted Cave, and to define the cultural interaction sphere in which they participated. The following sets of

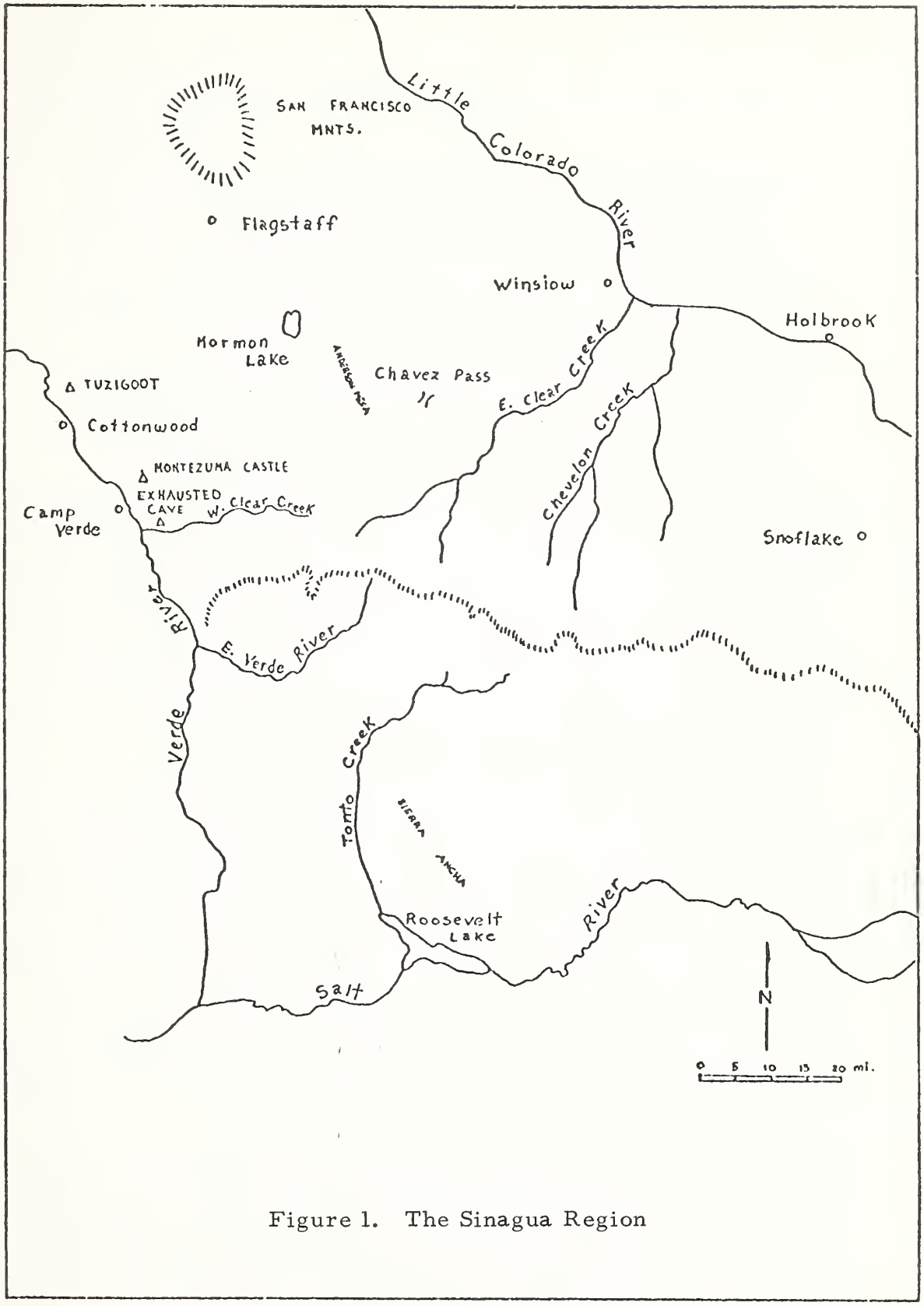

Figure 1. The Sinagua Region

questions imposed by this research proposal concern the interrelationship of the occupants of Exhausted Cave with their cultural and natural environment:

> With which extraneous groups was the study group affiliated? Is there a patterning to these affiliations? If there is a patterning, what is it, how does it relate to existing theories concerning Sinagua culture affiliations, and how does it relate to the cultural ecology of the Sinagua?
>
> What are the economic aspects inherent in the material culture of the study group? If there is a patterning to these aspects, what is it and how does it relate to the cultural ecology of the Sinagua?

Limitations are set by considering only contemporaneous assemblages for comparison, unless there is no contemporaneous data available and it is felt that problems concerning either Sinagua affiliations or economy can be viewed more profitably by comparing data from different time periods. Considerations for genetic relationships would prescribe a situation where the latter exception would apply. Comparisons will be made with regard to a few specific sites and major archeological syntheses on communal, areal, and regional levels.

The study centers on cultural ecology theory. Basic principles affecting the study state that an archeological artifact assemblage is intimately related to an archeological culture (Childe 1949:51) and that cultures adapt to influences exerted by other cultures as well as to influences from their natural environment (Sahlins 1968:368). The first of these premises establishes a basis for relating artifact assemblages to cultural behavior patterns. The second premise relates to the ecological interpretation of cultural affiliations.

The essential comparative theoretical works are by Colton (1946; 1960), Breternitz (1960), Schroeder (1953), Reed (1950), and Johnson (1965).

Community relationships among the Sinagua have been discussed primarily by Colton (1946) and Breternitz (1960). Colton envisioned an indigenous Sinagua culture occupying escarpment areas in the Verde Valley and a Hohokam population occupying the riverine habitats from about A.D. 700 to 1125. At about A.D. 1125 or shortly thereafter, he postulates a Sinagua overthrow of the Hohokam territory in the valley (1946:304). This latter invasion was presumably

made possible by a joining of forces of the Northern and Southern Sinagua, although this was not explicitly stated by Colton.

Breternitz' major work on the Southern Sinagua involves pit house sites located on West Clear Creek about a mile from Exhausted Cave. These structures represented a sequence of events dating from about A. D. 1 to 1100 or 1125. In the concluding section of his final report (1960:19-25), he assigned phase names to the various unnamed components and discussed each of them in developmental sequence. For the pottery making period beginning after A. D. 700, Breternitz claimed that Hohokam peoples inhabited the sites and that they continued to do so until about A. D. 1100 when these sites were abandoned. Sites post-dating A. D. 1100 are referred to by Breternitz as Southern Sinagua based on Colton's (1939) assignments of an A. D. 1100-1125 to 1300 Honanki Phase and an A. D. 1300 to 1400-1425 Tuzigoot Phase.

There is no really comprehensive synthesis of areal interrelationships among the Sinagua. Colton's (1946; 1960) theoretical concept of areal relations during this time period applies most directly to the Northern Sinagua, and only by his proposed invasion of the Verde Valley by this northern element circa A. D. 1100 do his ideas relate to the Southern Sinagua. In elementary form, Colton's thesis states that following the eruption(s) of Sunset Crater at approximately A. D. 1066, peoples from several neighboring regions relocated in the vicinity of Flagstaff, Arizona, where they took up residence alongside the indigenous population and shared the profits of farming the cinder mulch formed by the volcano eruption. The new colonies that joined the Northern Sinagua are supposedly members of the Kayenta Anasazi, Mogollon, and Hohokam cultures.

Regional relationships of the Sinagua are enumerated on in the works of Schroeder (1953), Reed (1942), and Johnson (1965). Schroeder's (1953) Hakataya tradition would have the pre-A. D. 1070 culture of the San Francisco Mountain area consist of a southern Colonial Period (Hohokam) paddle and anvil pottery manufacturing peoples residing in close contact with Anasazi grayware pottery producers. Then, between A. D. 1070 and 1120, he postulates the development of a Sinagua pattern wherein a Hohokam colony and populations of Anasazi and Mogollon settle the area, a thought first expressed by Colton (1932) and elaborated on by McGregor (1941). Schroeder believes this pattern moved into the Verde Valley at A. D. 1125 where it engulfed the pre-existing Pioneer Period Hohokam culture. He further speculates that this same pattern moved into the Tonto

and Gila Basins about A. D. 1150 and has since been mistakenly referred to as the Salado culture. It should be noted that Schroeder also considers the Prescott and Cohonina cultures as a part of the Hakataya tradition, developing along similar lines to the Sinagua.

Reed (1942) and more recently Johnson (1965) ascribe to a belief that a Western Pueblo tradition, including the Northern and Southern Sinagua, developed along the Basketmaker III Mogollon-Cibola Anasazi frontier and that it emerged as a separate cultural entity by A. D. 1000 or 1300. The finalized culture is conceptualized as a blending of Mogollon, Anasazi, and Hohokam traits, and encompasses the area south of the Little Colorado, east of the Verde, and north of the Gila Rivers. Some of the important distinctive communities within this Arizona region occur in the Flagstaff, Verde Valley, Forestdale, Roosevelt Basin, and Point of Pines areas. In New Mexico, the Reserve and Mimbres areas supported substantial communities of the Western Pueblo culture. The cultures represented in these areas are essentially the same as those mentioned above for the Hakataya with additional eastern communities. These two cultural schemes differ primarily in their origins and in the subsequent effect that these origins have on the developing cultures.

The research design for studying the cultural ecology of the occupants of Exhausted Cave was set up in planning stages. The first stage consisted of choosing a site suitable for a paleoecological study. Exhausted Cave was chosen on the basis of its location and visible productivity yield in terms of artifactual and ecofactual materials. The second stage involved the excavation of these materials. This stage was followed by an intensive analytical stage wherein the recovered materials were sorted, identified, and classified. Both macroscopic and microscopic techniques were used in the analysis of artifactual materials. The third stage utilized comparative techniques, both archeological and ethnographic, for the interpretation of the classes of artifacts. In the final stage, the materials were grouped into technological categories and trade categories. These groupings, in turn, were interpreted as economic patterns and as cultural affiliation patterns.

In its original format, the research design for this study focused on two major problem areas. The first area of concern had to do with determining the cultural affiliations of the inhabitants of Exhausted Cave, determining characteristics of their artifact assemblage, and

establishing controls necessary for interpreting paleoecological data. This portion of the study is the focus of this report. The second objective of the original study relates to the paleoecology of Exhausted Cave which is the subject of a joint research paper currently being compiled by the author and Dr. Richard H. Hevly of Northern Arizona University. It is hoped that this latter work will be made available in published form soon.

Chapter I

HISTORY AND ENVIRONMENTAL PROSPECTUS

HISTORY

The various archeological sites located on West Clear Creek near Camp Verde, Arizona, have attracted the attention of professional archeologists and amateurs alike for a period of about 85 years. The earliest recorded visit to the Clear Creek Ruins, of which Exhausted Cave is a part, was made by Dr. Edgar Mearns, an army surgeon who was then stationed at Fort Verde, Arizona. Mearns excavated caves on the upper terrace slope of the Clear Creek Ruins (Fig. 2) and examined the Montezuma Castle cliff dwelling, but did not describe his finds (1890:14). The first major archeological expedition into the area was made by Cosmos Mindeleff of the Bureau of Ethnology, who surveyed a number of sites along West Clear Creek and throughout the Verde Valley (1896). During this same time period, Jesse Walter Fewkes visited the West Clear Creek area and also conducted the first professional excavations in the Verde Valley at the Palatki and Honanki ruins (1898). Fewkes later surveyed and reported on sites located near the confluence of Walnut Creek and the Verde River (1912).

During the late 1920's and early 1930's, there was a concerted effort on the part of a few professionals to salvage archeological data and to solve relevant archeological problems in the Verde Valley, which was, by this time, falling waste to local collectors of Indian relics. Earl Morris, representing the American Museum of Natural History, excavated one of the larger caves in the Clear Creek group in an attempt to collect data relative to local prehistoric salt mining operations (1928:91-97). Harold S. Gladwin then conducted a series of surveys in order to delineate Hohokam penetration along the Verde River (1930a;b). A brief description of the Clear Creek Ruins and a site plan were presented shortly thereafter in Earl Jackson's 1933 archeological survey report of the Verde Valley (1933:43-44, 82). The King's Ranch site and a portion of the Fitzmaurice Ruin (Spicer and Caywood 1936), the Hidden House cliff dwelling (King 1933), and Montezuma Castle (Jackson and Van Valkenburgh 1954) were excavated that same year and during the following year. These sites yielded considerable information concerning the nature of Southern Sinagua material culture. In 1934, W.G. Atwell surveyed the Clear Creek Ruins for the National Park Service and, through his concern to

Figure 2. Clear Creek Ruins

protect this site from further vandalism, submitted a proposal to establish the Clear Creek Ruins as a national research monument (1934). Unfortunately, Atwell's attempt to preserve the Clear Creek Ruins never materialized; and, as he supposed, the site continues to this day to suffer at the hands of vandals. The excavation of Tuzigoot Pueblo also occurred during this period of intensive research (Caywood and Spicer 1935).

Survey work in the Verde Basin continued during the 1940's, and the Verde archeological records were extended by Ellen Edwards (1942) and the Clear Creek Ruins record was enhanced by Schroeder and Noteman (1946). Harold S. Colton's synthesis of Southern Sinagua prehistory was presented in his work, The Sinagua, at this period in time (1946). Schroeder continued his survey data collection at a ball court site at Sacred Mountain toward the end of this decade (1949).

In the next decade, research-oriented archeology, especially related to Hohokam problems, once again emerged and was augmented by salvage archeology projects. An interest in early lithic sites in the vicinity of Sedona, Arizona, was shown by Shutler (1950) who also excavated pueblo remains in the same area. The Hakataya concept, pertaining to cultural relationships and origins, was formulated and presented by Schroeder (1953; 1957). Lloyd Pierson excavated caves on Dry Beaver Creek (1955; 1956) and a pit house site on Wet Beaver Creek (1959). Salvage operations include sites excavated by Wasley (1957) and Breternitz (1958; 1960).

Paul Fish and Godfrey Whiffen excavated a pueblo site in the vicinity of Perkinsville, Arizona, in the mid-1960's (1967) and in 1968, excavations were resumed at the Fitzmaurice Ruin by the Barnetts (1974).

In spite of all the previous survey work in the area, the Verde Valley is still wanting for a comprehensive systematic survey. More excavations are also needed, particularly in respect to the very early pit house sites and late massive pueblo sites. Studies relating to technology, subsistence patterns, social structure and settlement patterns are virtually unheard of for the entire Sinagua culture. These are but a few of the problem areas that require additional investigation, and it would appear that a great deal more research must be done in the realm of the Southern Sinagua before its chapter in prehistory can be written.

ENVIRONMENT

Physiography

The physiographic character of north-central Arizona is basically mountainous. The Verde Valley presents a rather striking contrast to this generalized relief pattern. Structural formations in the basin are typically sedimentary in nature. The limestone and sandstone deposits that make up the white hills and red rock formations of the Verde Valley are principally shallow lake depositions, the result of the basin having been dammed during the tertiary period at its lower end by volcanic action. The present dominant features of the Verde Basin and site area are mesas, washes, flats, and alluvial flood plains. These topographic features were affected by chemical and mechanical deposition followed by stream cutting action and erosion under semi-arid climatic conditions (Allen 1937:1-2).

Another prominent feature of the area in the immediate vicinity of Exhausted Cave is the presence of evaporates. An outcrop of gypsum adjacent to the mesa on which the site is located is currently being strip mined. Six miles northwest of the ruins, a large salt deposit was mined both prehistorically by the Indians and in recent times by chemical contractors (Morris 1928). Several specimens of both gypsum and rock salt were recovered from Exhausted Cave.

Soils found in the Verde Basin are of three principal types. According to Allen, the soils found above an elevation of 5,000 feet are a desert border type soil called Dechutes. Below 5,000 feet is the well developed Coronado soil, a limestone derivative. The alluvial Gila type soil is characteristic of the flood plains (1937:6).

Hydrology

The Verde River and its tributaries make up the major drainage system of the Verde Basin. The river originates in the Chino Wash area north of Seligman, Arizona, and empties into the Salt River near Phoenix, Arizona. The western tributaries to the Verde are short and intermittent. Several eastern streams arising in the marginal areas of the Colorado Plateau are permanent tributaries.

Remnants of irrigation canals offer proof that the prehistoric inhabitants of the area farmed the flood plains along West Clear Creek. Though there is no direct evidence that the occupants of

Exhausted Cave employed irrigation methods, it has been established that the Southern Sinagua of this time period possessed such technology (Colton 1946).

Flora

The Verde Basin is generally thought to belong to the Sonoran Life Zone. The formation-class or biome of the study area is that of a desert-grassland. Actually, this type of grassland does not fit the proper definition of a formation-class. According to Lowe (1964:13), it should be considered as an ecotone or transitional region between grassland and desert biomes. Lowe describes the desert-grassland as being:

> . . . a broad and highly varied transitional region between the plains grassland (short grass plains) and the Southwestern Desertscrub of more recent evolution (Axelrod 1950). The climate is intermediate between desert and grassland, and a slight change in the precipitation evaporation ratio (for example, by a slight but significant rise in environmental temperature) can effect a pronounced change in the vegetation at a given locality (1964:23). [or a shift in seasonal distribution of moisture]

The desert-grassland ecotone concept presents an accurate account of the prevailing floristic environmental conditions in the site area. The actual plant communities tend, however, to vary with the physiography of the area.

Plant community zonation can be subdivided into four basic microhabitats. The first is the rocky hillside or mesa which the site itself occupies. Next in line of descent are the desert flats adjacent to all but the southern slope of the mesa. The flood plain adjacent to the southern slope constitutes the third major zone. The riparian habitat and washes complete the zonation pattern.

Dominant plants of the rocky hillside are creosote bush, indigobush, catclaw, snakeweed, falsepaloverde, and grasses. Occasional specimens of cacti, mesquite, yucca, joint-fir, juniper and other plants are present.

Cover on the desert flats is mostly grasses. Some desert shrubs have invaded this zone with mesquite and yucca being the most common types of woody plants.

The flood plain is dominated by mesquite, saltbush, and grasses. Some of the associated plants are wolfberry, buckthorn, and hackberry.

Vegetation along the West Clear Creek riparian habitat is essentially a deciduous woodland, characterized by cottonwood, sycamore, willow, walnut, alder, and hackberry.

An intensive study of the vegetation at the nearby Montezuma Castle National Monument was performed by W. B. McDougall and M. S. Haskell (1960). Their report gives a detailed listing of plants in the area, inclusive of the various zones. An early, now outmoded, report by Mearns (Britton 1889) and a more recent report of the vegetation of Montezuma Well by Art Clark (1963) provide additional reference material, but are not as broadly applicable as the work of McDougall and Haskell.

Fauna

Records of the faunal assemblage for the Camp Verde vicinity date back to the early 1900's (Taylor and Jackson 1916).

Among the large mammals to frequent the area in recent years are deer, antelope, coyote, and fox. Wapiti, bear, mountain lion, and peccary were probably more common in prehistoric times along the cliffs and riverine habitats, but are rarely encountered in the modern record. Bobcat, ringtail, porcupine, beaver (historically), badger, raccoon, and skunk are representative of the intermediate sized mammals. Various small rodents and their allies are prevalent in the area. Several species of bats also occupy the valley. Land and water birds are so numerous as to draw attention of ornithologists from distant regions.

In short, the Verde Valley with its natural accesses to nearby mountains and desert regions is a virtual paradise for sustaining a variety of wildlife.

Climate

Climatic records are available from the Montezuma Castle National Monument station within a few miles of the Exhausted Cave site and at an elevation of 3,180 feet. This station, and the Verde Basin in general, is in a semi-arid climatic zone. Twenty-four years of observations of climatic conditions at this station are reported by Green and Sellers (1964:265).

During the period between 1939 and 1963, the mean annual diurnal temperature for January, the coldest month of the year, was 59° F. Diurnal figures for July, the hottest month, averaged 101° F. Mean annual nocturnal temperatures were 27° F. for January and 63° F. for July. The day and night variation in temperature is characteristic of the semi-arid climate. The first freeze occurs around the 26th of October, the last occurring about April 18; thus, the duration of the effective growing season is about 190 days. The precipitation pattern in the basin, however, could also be an important factor affecting the length of the growing season, especially for the prehistoric farmers of the region.

Precipitation at Montezuma Castle averaged in excess of 11 inches annually during the 24-year study period. Extremes during this study period ranged from less than 4 inches to nearly 20 inches of rainfall annually. The records also show that the rainfall in this area conforms to the general Southwest pattern of winter and summer storms, with the heaviest rains coming in the late summer months. The excessive summer rains occur as a result of moist tropical air brought in by southerly winds being rapidly cooled as they rise over the higher elevations around the basin.

The possibility of violent floods during the late summer months and in the early spring (when the melting snows run off higher elevations) could have been a problem to the ancient farmers. Modern observations of flood damage in the area indicate how easy it would have been for a sudden flash flood to wipe out an entire crop planted in the alluvium adjacent to these streams. A recurrent pattern of such floods could have substantially reduced the length of the growing season. It is also feasible that changes in ground and bank cover have altered the flood pattern over the years so that present-day conditions are not applicable to the situation during prehistoric times.

Chapter II

SITE DESCRIPTION AND EXCAVATION METHODOLOGY

LOCATION AND PHYSICAL DESCRIPTION

Exhausted Cave (NA10,769) is a component of the Clear Creek Ruins (NA2806), which is located approximately five miles southeast of Camp Verde, Arizona, and one mile north of Highway 279. It is situated within the boundaries of the Coconino National Forest in Yavapai County in the NW$\frac{1}{4}$ of Section 11 of Range 5 E. of Township 13 N.

The cave, a natural feature in the Verde Formation, occurs at an elevation of 3,400 feet on the south slope of the mesa below the main pueblo ruins. It is roughly L-shaped and 2 m. wide with two walled entranceways (Fig. 3). The primary entranceway on the east faces slightly to the southeast; the secondary entrance faces more to the southwest.

Outside the cave in the open area between the two walled entranceways is a natural ledge area which is protected on three sides by a slight cliff face and semi-walled-in on the south side (Fig. 4a). This outcrop on an otherwise steep slope provided a level exterior work area for the cave's occupants.

Upon entering the cave through the main entranceway and immediately behind the east section of the wall is a crevice exposed to the talus slope above. Below the crevice is a large storage cist (Fig. 4b). The ledge in front of the cave drops off gradually upon entering the cave, giving a sunken effect to the main area of the cave. The floor is level except for the curvature at the base of the cave walls and at the front where the ledge angles in. Floor features include two cists, several firepits, and a slab-lined hearth. Deposits in this part of the cave consisted of a talus cone, formed as slope debris entered via the crevice at the mouth of the cave, and cultural fill, part of which had been disturbed by vandals to the depth of nearly 50 cm.

At the rear of the cave, a natural ledge was modified to form a level, walled-in bench area (Fig. 4c). The bench deposits were fairly level with a heavy organic overburden. At the far end of the bench, a large spall had disengaged from the roof of the cave and came to

Figure 3. Exhausted Cave

a, Outside Work Area

b, Cist and Firepit

c, Bench Area

d, Ceiling Cache

Figure 4. Natural Features of Exhausted Cave

rest on the bench deposits. An extensive wood rat nest covered the surface of the deposits at the west end of the bench, completely engulfing the fallen roof spall. A scaled storage chamber occurs in the ceiling above the bench (Fig. 4d).

The low roof of the cave, less than one meter over the bench to a meter and a half in the main section, must have posed a problem to the inhabitants as it did for the excavators. Prior to excavation of the fill in the unpotted areas, it was necessary to assume a prone position in order to map the cave as crawl space was definitely restricted.

EXCAVATIONS

Methods

Initially, an arbitrary elevation datum was established outside the cave. A plane table and alidade were then set up on this reference point to map the outside area and primary southeast entrance to the cave. The interior of the cave was then mapped by using a system of one meter square grids, which tied into the outside datum. The grids were prefixed with letter designations, then numerically distinguished from the front to the back of the cave as shown in Figure 5.

The E series of grids was excavated in arbitrary 10 cm. horizontal levels. This served as an exploratory trench extending to the back of the cave. The subsequent removal of deposits in Row 7 exposed the cave's natural dogleg and eventually the west entrance to the cave. The series of B grids was excavated next, and wherever possible stratigraphic levels were noted for the remainder of the cave. Stratigraphic control over the cultural deposits was evident in profile only in Squares F6, F7, and F8. The other grids, including the A, C, and D series and Squares F4 and F5, were also excavated in arbitrary 10 cm. levels. Attempts at defining culturally relevant stratigraphic divisions failed in all these grids except Square F5 where an occupational floor was discovered approximately 10 cm. above the bedrock.

The excavated deposits were all passed through a 1/4-inch mesh, followed by screening through a 1/8-inch mesh. Large and small artifacts and macroscopic plant remains were collected in this manner. Flotation samples were taken beneath the finer screen. Because of the restricted space inside the cave, it was necessary to collect the deposits in buckets and carry the materials outside

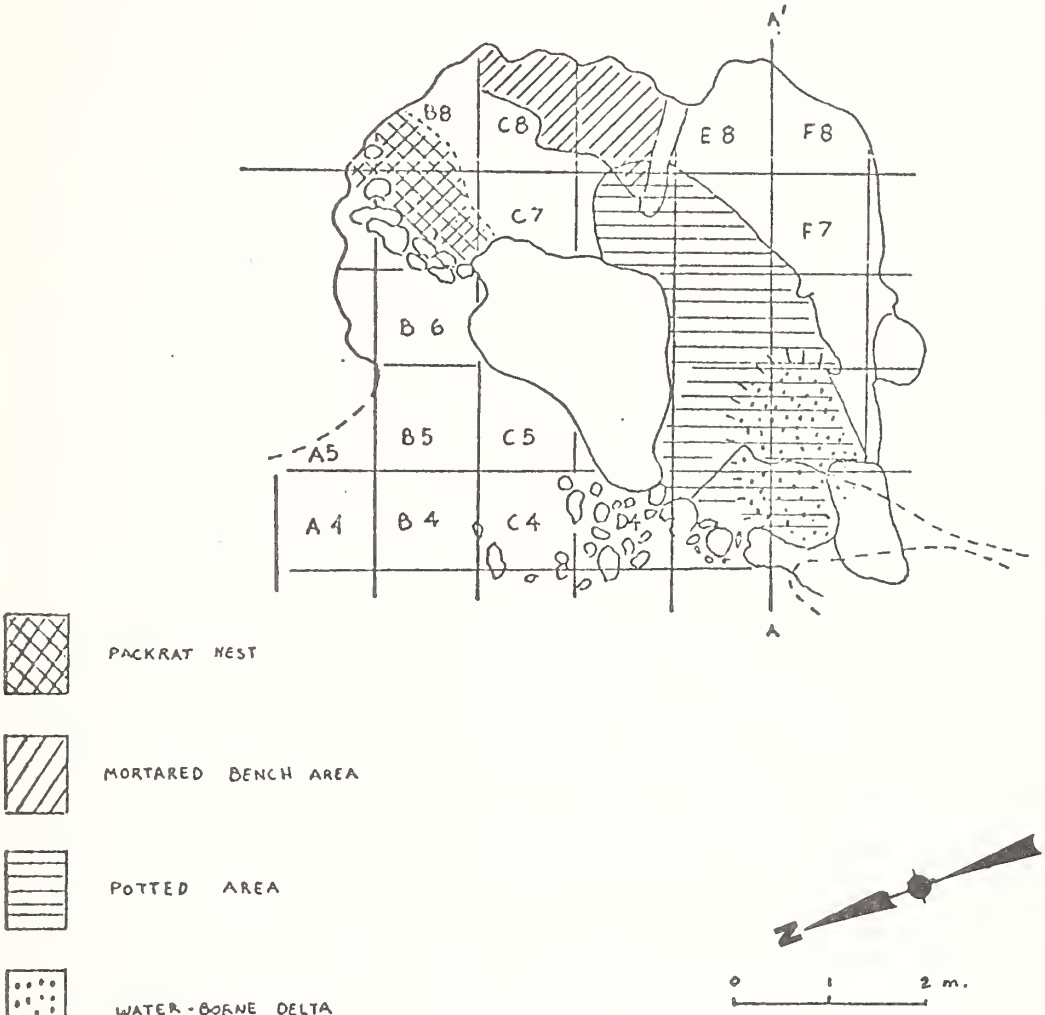

Figure 5. Plan View of Exhausted Cave

to the talus slope where the actual sifting took place. Disturbed deposits were infrequently passed only through the 1/4-inch mesh, without flotation collections. Due to an overabundance of plant and small animal remains in Squares F6, F7, and F8, a small pan screen was used to obtain even finer gradients. This was accomplished by transporting the materials in these squares to the laboratory for separation. At this time, only a portion of the latter materials have been completely analyzed.

Description of Deposits

The area outside the cave was buried beneath a steep talus slope. The extreme southern edge of the ledge was generally void of any overburden; and, where deposits existed, they tended to be relatively shallow. Nearer to the cave, the deposits approached a meter and a half in depth and completely concealed the rear entranceway. The homogeneous character of the deposits and cultural materials prevented the establishment of a chronological vertical profile in this area.

Fill carried inside the cave via an aperture located behind the main or east entranceway was a mixture of cultural debris and water transported rock, gravel, sand, and silt. Natural stratigraphy was not discernible in profile toward the front of the cave.

Bench deposits were gradational, and there was some mixing of the deposits caused by rodents, making it difficult to distinguish natural divisions in the sediments.

Throughout most of the cave, it was impossible to observe any natural stratigraphic levels; in a small area between the front of the cave and the bench, there were, however, undisturbed deposits in which seven distinct strata were defined (Fig. 6).

Stratum I, the lowest stratum, was a man-made mortared floor. The mortar served to level out the uneven surface of the bedrock floor and natural bench toward the rear of the cave. This stratum was 2 to 10 cm. thick, the thickest and most expansive segment occurring on the bench. A few utility sherds and ecofacts were recovered from this layer. The pottery analysis indicates the mortared floor was laid down sometime between A.D. 1120-1130.

Directly above the mortar layer was a deposit of water-laid sediment which was designated as Stratum II. This zone was made up of a

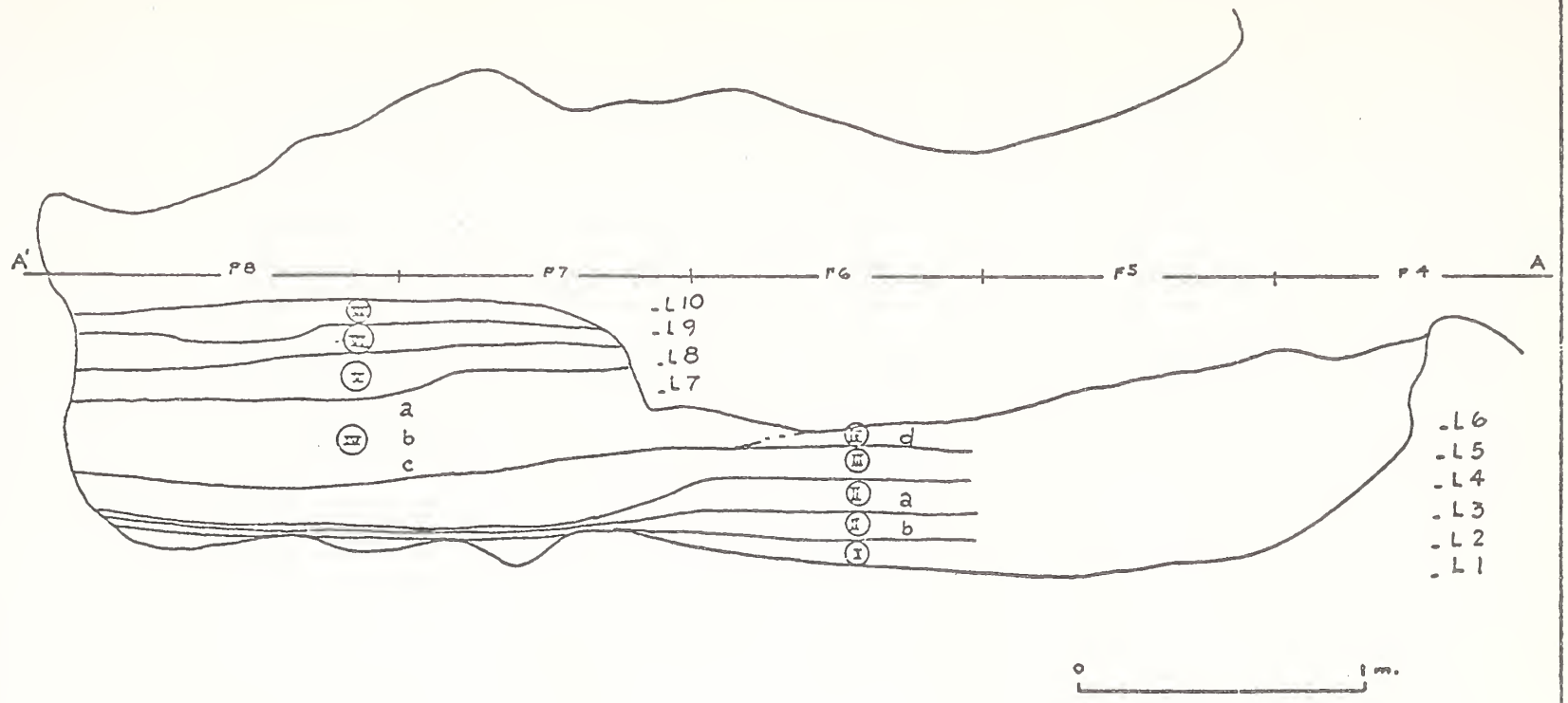

Figure 6. Profile of Exhausted Cave Deposits

lower substratum consisting of mud-cracked clay loam and an upper substratum consisting of thin plies of loam. A scant number of artifacts and a heavy concentration of ecofacts had worked down into the upper substratum. Stratum II was, however, generally void of cultural materials and therefore considered to be a sterile layer.

A pronounced change in sediment composition and a sharp increase in density of cultural remains, including large quantities of plant and vertebrate material, differentiated Stratum III from Stratum II. Stratum III consisted of a mixture of unconsolidated sediment and fine gravel. The pottery sherds indicate that the occupational deposition probably took place from A. D. 1250 to 1275 or 1300.

Stratum IV was recognized only in Square F6 and was unique in that the sediment was mostly composed of sand. This layer was deposited after A. D. 1300.

Deposits in Stratum IV were homogeneous and characterized by the inclusion of abundant rock and gravel. The finer sediments of this zone ranged from a sandy loam in the front of the cave to a sandy clay loam toward the rear of the cave. Arbitrary 10 cm. levels designated a, b, c, from top to bottom were incorporated to subdivide this stratum since it was nearly 30 cm. in depth as compared to a uniform 10 cm. depth for the other strata. Artifacts were mostly concentrated in levels c and a; ecofacts were present in large quantity only in levels c and b. Level a had few ecofacts. This stratum dates from about A. D. 1275 or 1300 to 1320.

Strata V, VI, and VII all post-date the occupation of the cave and, therefore, represent sediment accumulations between A. D. 1320 and 1970. Within these, Stratum V was essentially a sterile layer consisting of a sandy clay loam soil and a lens of gravel. Stratum VI consisted of a sandy clay loam soil, but was finer in sand texture than Stratum V. The artifact count was low, and seeds were conspicuously absent from this layer. The soil type in Stratum VII was identical to that in Stratum VI, and there were markedly more artifactual materials and ecofacts present.

Chapter III

LITHIC AND MINERAL ARTIFACTS

CHIPPED STONE

Basic classification of the chipped stone artifacts adheres closely to the morphological typologies set forth in Haury's Ventana Cave Report (1950). In exceptional cases, it has been possible to classify tools more precisely into their functional categories by utilizing the detailed morphology of prepared edge angles devised by Wilmsen (1968) and on the basis of wear patterns such as described in Semenov's work on prehistoric lithic technology (1970). These latter techniques of classification were used on tools exhibiting measurable edge angles and whenever wear patterns were visible using microscopic power assistance. Lithic materials generally considered as waste flakes are classified as either utilized flakes or as debitage and were not analyzed in terms of their possible functions. Most of the technical terms used to describe the chipped stone artifacts can be found in Crabtree's monograph on Flintworking (1972).

Projectile Points

The 65 projectile points recovered from Exhausted Cave, including complete and fragmentary specimens, are varied forms of small triangular arrow points that differed primarily in the morphological appearance of the blade edge and base (Fig. 7). The length of these points ranges from 14 to 33 mm., width from 9 to 17 mm., and thickness from 2 to 6 mm. The average for most classes is about 20 mm. long, 12 mm. wide, and 3 mm. thick.

Notchless points appear to be common throughout the occupation of the cave. There are three types of notchless points which are distinguished mainly by base shape. The first type consists of a single obsidian point with a straight base and straight blade edge. The dominant type, represented by ten specimens, has a concave base and a variable edge shape. Five of these are made of obsidian and the remainder of either chert or chalcedony. One of four specimens of straight-sided points with convex base occurs in the early Honanki Horizon which makes this the earliest type of projectile found in the cave.

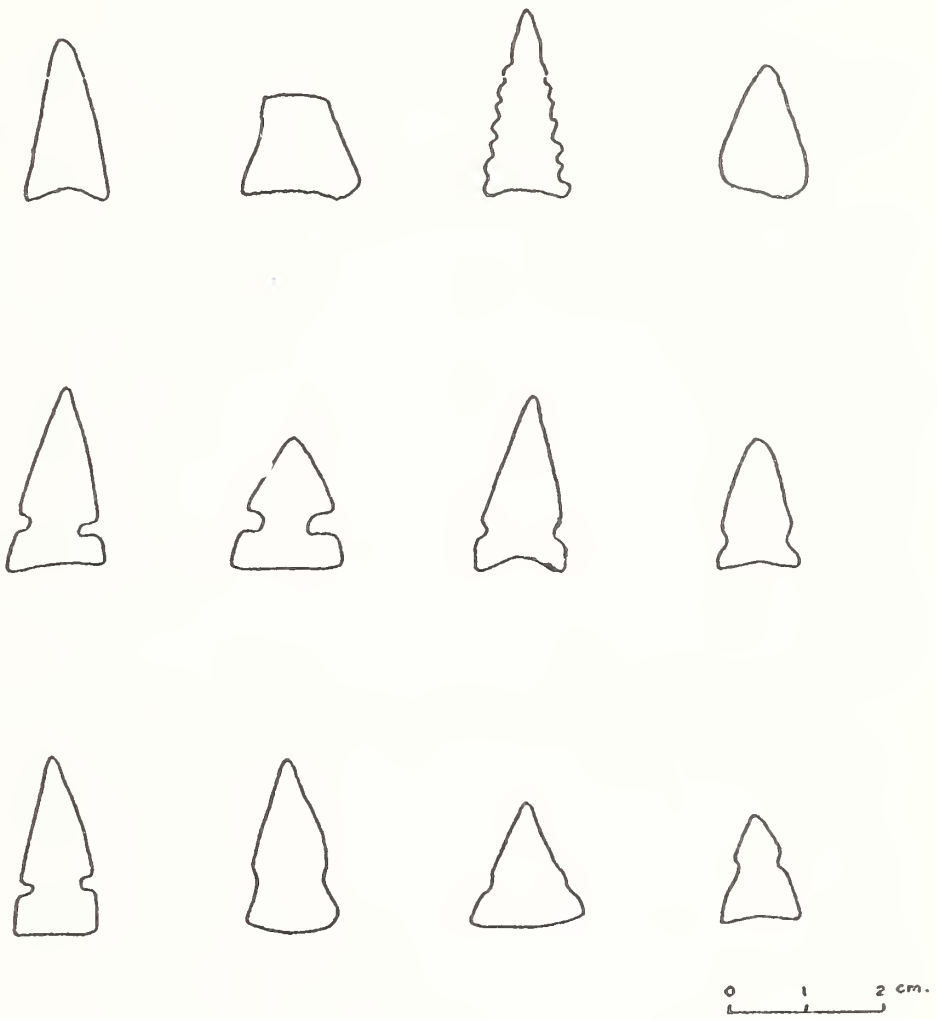

Figure 7. Representative Projectile Points from Exhausted Cave

A much smaller group of points have serrated blade edges. One of these, a squat appearing point of jaspar, is thought to be of marginal value as a projectile due to the extreme thickness of the base, 6 mm. thick. This point also has a straight base which further distinguishes it from the other two obsidian members of the group.

Shouldered points are also uncommon, there being only one specimen found in the entire cave. This obsidian point has a straight-edged blade, expanding stem, and convex base.

Side-notched projectile points are, by far, the most abundant. They are also the most varied in form of any of the groups of points. In addition to the occurrence of both straight and concave bases, they have two basic stem forms. Three side-notched points of obsidian are characterized by the combination of a straight base and expanding stem. As a group, these are somewhat shorter than the other points. Another type of side-notched point has a straight base, but differs by possessing a parallel stem. Six obsidian points are of this type. An expanding stem and a concave base distinguish the third type of side-notched projectile point. These are made of obsidian, basalt, and chalcedony. A single side-notched point of chert has a concave base and a parallel stem. This specimen occurs in Honanki Phase deposits while the aforementioned side-notched points are apparently confined to Tuzigoot Phase deposits.

Projectile points which appear to have "ears" are really shallow side-notched points that have notched bases. In a few instances, the lateral and basal notches have been emphasized by rounding the spurs. Two types of "eared" projectile points are recognized in the collection. Five points which make up the first type have a single basal notch; the other type is represented by one specimen that has a double-notched base. Materials from which the basal-notched specimens are made include obsidian, basalt, chert, and chalcedony.

One unfinished projectile point rounds out this artifact category. The specimen is an obsidian preform that has been worked along two edges to near completion of the blade outline. Similar, but undiagnostic chipped stone artifacts and other possible projectile points, are discussed under the category of bifacially retouched flakes.

Choppers

Five choppers have been recovered. Four of these tools are made from basalt and chert cobbles, and they have a lateral working edge. The fifth specimen is a flake chopper made of basalt. Both chert specimens show utilization marks which indicate that they have been used for hammering as well as chopping activities.

Planes

Artifacts thought to have been used as planes include three pieces of chert, two of basalt, and an agate core. One of the chert specimens and one of basalt are roughly oval-shaped and domed. They have been trimmed around their entire margins. Three specimens including the core are irregularly shaped, high-backed and only partially trimmed. The remaining specimen is an elongated, domed plane that has been trimmed on one end. Flake scars occur on the dorsal and ventral faces of margins on most of the specimens. Those on the dorsal face are crushed or shattered while those on the ventral face are thin clean flakes that have been peeled off the artifacts. A slight polish is also evident on the ventral face of one specimen.

"Mescal" Knives

Thin slabs of igneous rock that have been chipped along one side to produce a sharp cutting edge occur in both horizons. There are four whole or nearly complete specimens and 58 fragments presumably of "mescal" knives. Some of the knives have been worked to a dull edge on the side opposite the cutting edge, creating a backing platform suitable for applying pressure to assist in the cutting operation. The whole specimens are fairly uniform in size at 11 to 14 mm. in length, 7 to 13 mm. in width, and 1 to 2 mm. in thickness.

Large Pointed Knife

A large biface occurs in Hearth 17 in association with a trough metate, an end scraper, and deer antler. The subtriangular shaped knife is 142 mm. long, 54 mm. wide, and 27 mm. thick. The negative flake scars indicate a soft hammer manufacturing technique with several instances of hinge and step fractures, possibly due to crystalline impurities and air pockets in the rock. Secondary (retouch) flaking appears to be minimal and is concentrated on the short side near the thinned broad end. Use scars which are present

on the long margins of the blade indicate a short period of utilization for cutting activity.

Small Pointed Knife

This knife is comparatively small at 38 mm. long, 17 mm. wide, and 6 mm. thick. Like the larger knife, it is subtriangular in shape; the longest edge on this specimen, however, has been crushed to provide a backing platform. It has been pressure flaked from an obsidian flake and thinned at the broad end.

Flake Knives

Two bifacial implements are made of fine-grained basalt flakes. These appear to be from the same source of material as the large pointed knife. Both specimens are soft hammer flakes with prepared ground striking platforms and terminated step fractures. One knife is 47 mm. long, 34 mm. wide, 5 mm. thick, and oval-shaped. The other specimen is 49 mm. long, 43 mm. wide, 6 mm. thick, and disk-shaped. Retouch flaking appears to be limited to shaping of the edges and does not carry across the flake faces. Wear on the ovoid knife is minimal; the discoidal knife shows considerable wear in the form of use scars and striations on either face of the margin.

Utilized Flake Knife

An irregularly shaped smooth-faced flake of quartzite has been utilized as a knife and possibly as a saw. One margin of the flake has alternate use scars removed from either face in a typical cutting pattern; and the other margin, which is coated with a bright red stain, appears to be slightly serrated. The two ends of the tool are broken off, but the remaining section is 64 mm. wide and 17 mm. thick. It is believed to be a component of Cache 1.

Micro Bifaces

This category of obsidian bifaces includes three worked blades, three irregularly shaped objects, and an ovate object. The blades range from 20 to 36 mm. in length, 10 to 15 mm. in width, and 2 to 4 mm. in thickness. It is possible that these are projectile point preforms. The irregularly shaped objects have crushed edges, and the one complete specimen has a single pronounced shoulder to suggest that it has been hafted to some type of handle. The latter specimen is 23 mm. long, 16 mm. wide, and 5 mm. thick. The crushed edges

on these specimens would seem to indicate heavier use than is normally applied to projectile points. The ovate object which is 24 mm. long, 19 mm. wide, and 6 mm. thick does not have crushed edges; therefore, it would be either a projectile point preform or a small cutting tool, as implied for the shouldered specimen.

Bifacially Retouched Flakes

Eight bifacially chipped obsidian flakes and one of chert are mostly tool fragments that are lacking diagnostic features that make classification feasible.

End Scrapers

Two whole scrapers and an end scraper fragment have been recovered from the cave deposits. The fragmented specimen and one of the whole specimens are made from thick, hard hammer obsidian flakes. The complete specimen is rectangular and corner-notched. It is 41 mm. long, 32 mm. wide, and 6 to 12 mm. thick. The thick portion occurs at the corner notch on the ventral face of the proximal end of the flake. Flake scars in the notch indicate secondary use of the tool as a denticulate scraper. The other whole specimen is rectangular and made of fine grained basalt of the type used in the manufacture of the large pointed knife. The flake on which the scraper is made has been produced by the soft hammer technique, and there is evidence of platform preparation similar to that found on the flake knives. The scraper is 50 mm. long, 42 mm. wide, and 8 mm. thick.

Side Scrapers

This group of artifacts consists of three whole unifacially retouched tools. A square corner-notched specimen of obsidian is 30 mm. long, 30 mm. wide, and 9 mm. thick. It has been worked on the ventral face of one lateral margin, on the dorsal face of the opposite margin, and on the dorsal face of the notch. The second specimen, also of obsidian, is 37 mm. long, 14 mm. wide, and 5 mm. thick. It is irregularly shaped and worked on alternate sections of both faces around the entire margin. The third specimen is a subtriangular chert scraper that is worked about half the distance of either lateral margin on one face and half on the other face. This implement is 28 mm. long, 23 mm. wide, and 9 mm. thick.

Unifacially Retouched Flakes

Four scraping tool fragments and a small unifacial retouch flake make up this category. The five specimens are made of obsidian.

Graver

The only graver is made from a thick chert flake that has been pointed at one end. It is 26 mm. long, 13 mm. wide, and 10 mm. thick.

Perforators

These tools, including two obsidian specimens and two of local chert, have straight to slightly crescent-shaped tapering shafts that are triangular in cross section. They range from 17 to 36 mm. in length, 5 to 12 mm. in width, and 3 to 6 mm. in thickness. One specimen is double ended, and the rest have a single pointed end.

Drills

Seven drills have been separated out from the chipped stone assemblage. These implements are readily discriminated from perforators and gravers by their characteristically long tapering shaft and by the diamond shape of the cross section of the shaft or tip. One drill made of fine grained basalt is straight or plain shafted and 46 mm. long, 10 mm. wide, and 7 mm. thick. Five of the drills are made of obsidian. Two of these, a whole and a partial specimen, have square thinned bases which average 13 mm. in width and 5 mm. maximum thickness. The whole specimen is 44 mm. long and slightly notched for hafting. The other two obsidian specimens have single shouldered flanges on their proximal end. The smaller specimen is 17 mm. long, 8 mm. wide at the flange, and 3 mm. thick. The larger specimen has a broken tip and is presently 30 mm. long, 21 mm. wide, and 4 mm. thick. A chert specimen which is broken off at the tip has a flat rounded flange. It is 9 mm. wide at the flange, 3 mm. thick, and probably would not exceed 25 mm. in length. The last specimen has pronounced hafting elements but is missing its base.

Chipped Stone Tool Kit

The 26 multi-purpose chipped stone implements that make up this tool kit (Fig. 8 and Fig. 9) are mostly fashioned from soft hammer produced flakes. These tend to be very uniform in size, with the majority

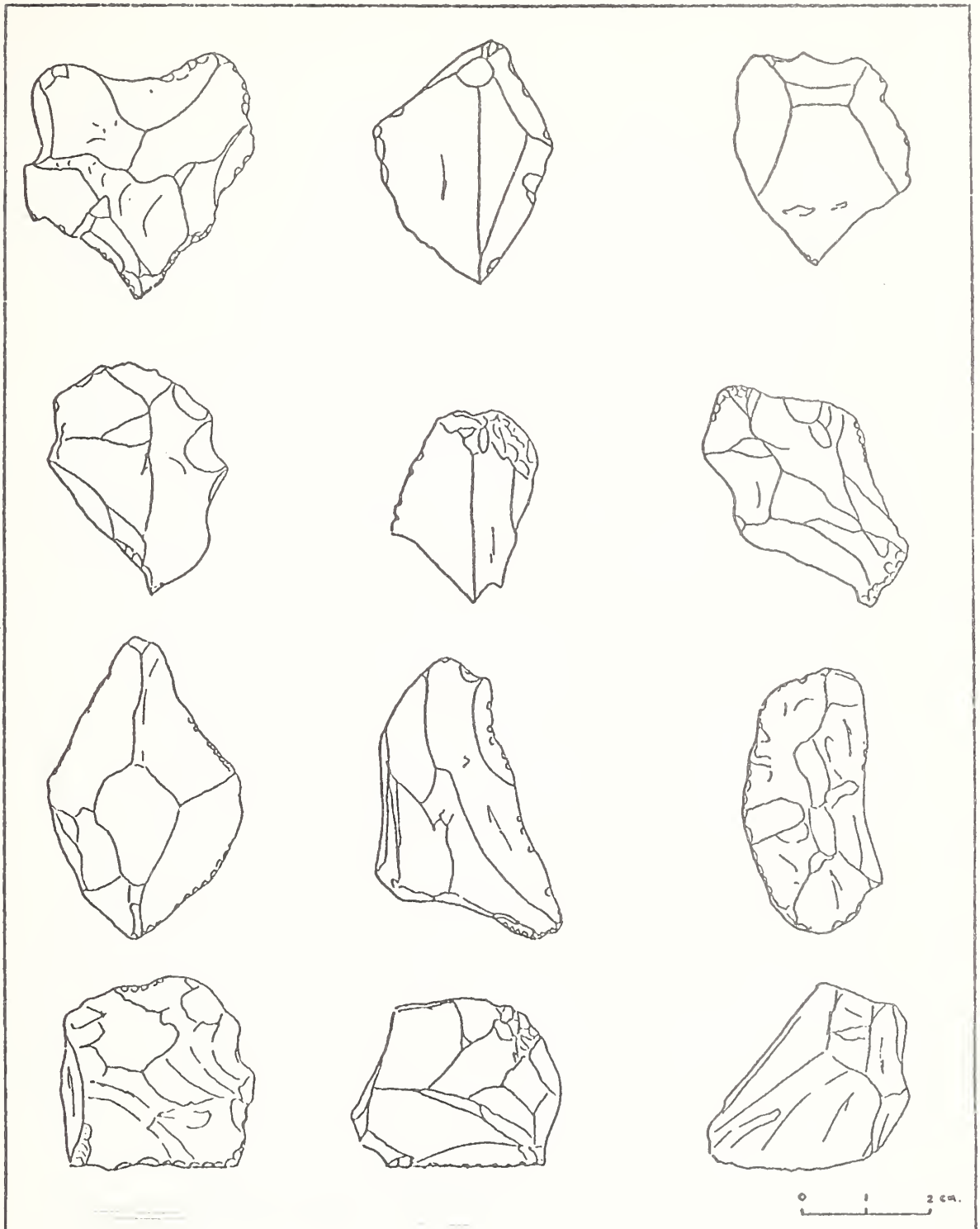

Figure 8. Multipurpose Tools from Medicine Bundle, Cache 1. Primarily Used as Gravers, Wedges, and Knives.

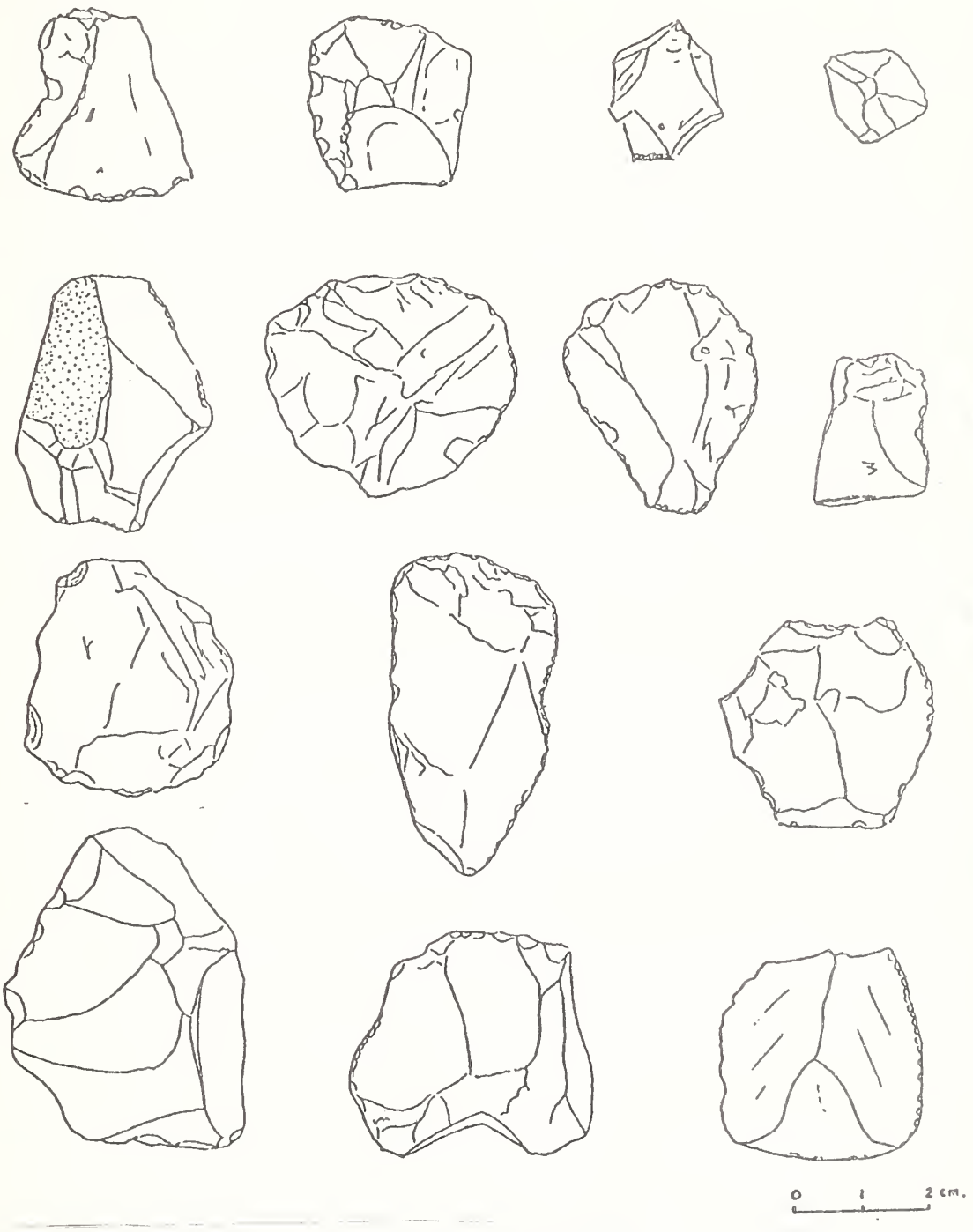

Figure 9. Multipurpose Tools from Medicine Bundle, Cache 1. Primarily Used as Scrapers and Knives.

of specimens ranging from 30 to 49 mm. in length, 20 to 38 mm. in width, and 6 to 9 mm. in thickness. Thinness appears to have been controlled by trimming the dorsal face after the flake was detached from the core. There is even one instance of thinning by removal of the bulb of percussion from the ventral face of a flake. Both hinge and step fractures are present, but do not occur frequently. Platform preparation, which is evident on a few of the specimens, probably aided in the control of length and width variables. Evidence of soft hammer technique consists of Eraillure scars, diffuse bulbs of percussion, and lips formed below the striking platform on the ventral face.

Evidence of retouch is minimal, necessitating a considerable reliance on the detection of use scar patterns in determining tool types. These classifications were further defined by measuring edge angles, which were interpreted in terms of functional categories.

Gravers. Graver tips occur on about a third of the specimens. They are characterized by a triangular profile and cross section, with an edge angle of about 45 degrees. The tips exhibit a polish resulting from use.

Wedges. This category is used to describe rounded chisel-like projections found on several of the flake tools. Sixty degree edge angles typify the wedges. Small chips on the underside of the beveled edges supposedly indicate use as chisels or gouges (Semenov 1970:149). The term wedge is used here to distinguish this group of relatively acute angled marginal projections from the steeper edged projection referred to below as a chisel.

Chisel. This single occurrence character is a squared projection with an edge angle of 80 degrees. The choice of the term chisel as applied to this tool as opposed to the round projections rests mainly on morphological appearance and analogy with modern chisel forms.

End Scrapers. Steeply beveled margins on four of the specimens are referred to as end scrapers. Most of these edges conform to a 75 degree angle and show considerable wear, sometimes with use striations clearly visible under microscopic power. These striations assisted in classifying the specimens (Semenov 1970:88, Fig. 31). Use scars and striations occur unifacially on the distal margin.

Side Scrapers. These moderately beveled margins hold to a fairly standardized 55 degree angle. Use scars are primarily confined to

only one face of the artifact; i.e., they are unifacial. It was observed, however, in more than one instance that bifacial wear patterns were superimposed on this type of tool. Undoubtedly, there is some overlap in usage of margins of this sort. There is a common occurrence of side scraper margins in this assemblage.

Discoidal Scraper. This tool is closely allied to the side scraper category as its 50 degree edge angle attests. It is unifacially trimmed.

Hollow Scrapers. The frequently encountered hollow scrapers are indented margins with edge angles clustering at about 70 degrees. Use scars are unifacial.

Denticulate Scraper. One example of this tool was present. It is continuously serrated on both lateral margins. The serrations and accompanying use scars appear on either face of the flake. Edge angles are 70 degrees, which is consistent with the hollow scraper pattern.

Knives. Bifacial margins, usually recognized by use scars, have a wide range of edge angles. Thirty to fifty degree angles on a single margin are not uncommon. The average for the edge angles is 35 degrees; but there are essentially two groupings, one at about 30 degrees and the other around 40 degrees. There is nearly always a suitable backing platform, either on an adjacent margin or on an opposite side to the cutting edge. Knife margins also occur superimposed on side scraper margins, as mentioned earlier.

Wilmsen (1968) and Semenov (1970) associate edge angles found on prehistoric tools with the functional operations of the tools. Their complementary discussions on this subject have led to establishing continuous sets of edge angles which can be equated to differing tool performances. According to Wilmsen (1968:986), edge angles between 26 and 35 degrees are intended for cutting operations. Those between 46 and 55 degrees are used for skinning and hide-scraping, shredding sinew and plant fiber, and for cutting dense objects such as horn, bone, and wood. Backing platforms may also be beveled within this latter range. Edge angles from 66 to 75 degrees are specific to working wood and bone and for shredding heavy fiber. Accessory tips and notches are said to be common to tools falling within this latter range.

Semenov (1970:20) further remarks concerning chipped stone artifacts that 35 to 40 degree edge angles occurring on tool margins infer whittling operations, and he gives a range of 75 to 80 degrees as typical of end scraper edge angles employed for skin dressing (1970:88).

Recent studies involving Australian Aborigine Culture (Gould, Koster, and Sontz 1971) point out that certain correlations exist between working edge angles of tools and their functional classifications. Woodworking scrapers, called "purpunpa," and knives, called "tjimari," were examined for use-wear patterns. The comparative study of tool classes demonstrates a clustering of edge angles from 40 to 89 degrees for the "purpunpa" adze scrapers; whereas, the "tjimari" knives cluster between 19 and 59 degrees.

In the Exhausted Cave collection, the only tools classed as knives are those which show a bifacial wear pattern and demonstrate edge angles consistently less than or equal to 40 degrees. These, according to the above interpretive functional categories, are cutting tools used to cut meat and skin. Only two of the multipurpose tools are thought to have been used primarily as knives. The preponderance of steep-edged implements, including the various scrapers and chisel-like tools, can be classed as wood, bone, or fiber working tools. This chipped stone tool kit may be said to have a variety of functional uses, mostly adapted to woody, bony, and fibrous materials.

Utilized Flakes and Debitage

About 6,000 unretouched flakes from the excavation of Exhausted Cave have been analyzed. A small quantity of the material is from the early deposits and does not appear to be of much interpretive value. The distribution pattern for the Tuzigoot Horizon shows, however, that the bulk of the utilized and nonutilized materials occurs on the bench inside the cave and that the relative frequency of occurrence of cortical flakes is greatest on the flat area outside of the cave. This suggests that most of the actual chipping activities took place outside or near the mouth of the cave and that the flakes were mostly stored and used inside. The vast majority of flakes are either basalt or chert, with subordinate amounts derived from obsidian and various other cryptocrystalline materials.

GROUND STONE

The classification of ground stone artifacts is in accordance with Woodbury's report on stone materials from northeastern Arizona (1954). Artifacts of ground stone are mostly associated with the Tuzigoot Horizon; those which belong with Honanki Phase assemblage are noted.

Metates

The collection of troughed metates consists of four fragments and two partial specimens. The partial specimens, which are broken transversely in thirds, range from 22 to 28 cm. in width and from 11 to 12 cm. in thickness. The grinding surface on both specimens is 15 cm. wide, indicating the conjunctive use of one-hand manos. These are the only metate specimens recovered, and they are made of vesicular basalt.

Manos

Rectangular, ovate, and irregularly shaped manos occur in the cave deposits.

Rectangular. Manos of the first type include a whole one-handed mano, a whole two-handed mano, three incomplete two-handed manos, and eight pieces of rectangular manos that could not be further classified. The one-handed mano is 13 cm. long, 9.5 cm. wide, and 8 cm. thick. The complete two-handed specimen is 19 cm. long, 9 cm. wide, and 4 cm. thick. The rectangular manos, with two exceptions, are made of basalt. The two exceptions are fragments, both made of sandstone.

Ovate. Ovate-shaped manos include two incomplete specimens made of basalt.

Irregular. Two of the manos are irregularly shaped basalt cobbles. The smaller of the specimens is broken at one end. The larger specimen is 21 cm. long, 11 cm. wide, and 7 cm. thick.

Grinding Slabs (?)

Two fragments of tabular fine-grained volcanic rock that are ground smooth on one surface appear to be grinding slabs, but may be large flat abraders.

Grinding Stone

This artifact is a large basalt cobble that has been ground on one side, stained with hematite, and pecked on ends and edges. It is 30 cm. long, 11 cm. wide, and 10 cm. thick.

Pigment Grinder

Another grinding implement, made of vesicular basalt, has been shaped in the form of a trapezoid. It is 13 cm. long, 7 cm. wide, and 3 cm. thick. Surface stains indicate that limonite, hematite, kaolin, and other minerals have been ground on various occasions with this tool. Undoubtedly, the primary use of this artifact is for grinding minerals into pigments.

Rubbing Stones

Cobbles that are worn smooth on one or more surface areas include one whole specimen, 10 cm. long, 6 cm. wide, and 3.7 cm. thick, and five broken specimens.

Pounding and Grinding Stone

This is a large, vesicular basalt, elongated rock. The ends are shattered as a result of intense pounding. Wear caused by grinding is evident on one side. The possibility that the tool has been used for shaping and finishing wall materials is suggested by its association with the bench retaining wall.

Pounding and Rubbing Stones

Twenty pounding and rubbing stones range from 6 to 12.5 cm. in length, 4 to 8.5 cm. in width, and 1.8 to 4 cm. in thickness. Twelve are limestone, six sandstone, and two basalt.

Pounding and Abrading Pebble

A small quartzite pebble appears to have been utilized for light pounding and abrasive tasks. Deep striations occurring on the flattened sides indicate that sharp objects have been in forceful contact with the stone. The tool is 3.4 cm. long, 2.4 cm. wide, and 0.8 cm. thick.

Grooved Abrader

A disk-shaped quartzite stone about 8.2 cm. in diameter has a 0.8 cm. wide transverse groove deeply worn into one flat side. Similar types of artifacts are commonly referred to as arrow shaft abraders.

Nock Files (?)

Two small objects made from 0.3 to 0.5 cm. thick tabular pieces of basalt and schist closely resemble artifacts from Canyon de Chelly described as arrow nock files (Young 1973). The working edge on the schist specimen is grooved at regular intervals to produce a serrated edge and usage striations are parallel to the margin on both specimens.

Axes

The axe collection includes one complete three-quarter grooved axe and two axe bits. The whole specimen is 17 cm. long, 8 cm. wide, and 2 cm. thick. Although the identifications have not been confirmed, these appear to be made of diorite.

Rough Cylinders

Two crudely formed cylinders of vesicular basalt average 6.5 cm. in length and 2.5 cm. in diameter. Such artifacts are called corn huskers or pestles, but to the author's knowledge, the actual function of these rough cylinders has never been demonstrated.

Stone Beads

The stone assemblage includes beads made of argillite, steatite, serpentine, and turquoise. There are six beads of argillite. Four are cylindrical beads ranging from 3.2 to 4 mm. in diameter and 1 to 1.2 mm. in thickness. One of the two non-cylindrical argillite specimens is a 1.2 mm. thick disk bead blank 7.5 mm. in diameter and the other is a 4.7 mm. square bead preform that is 0.8 mm. thick.

Steatite specimens include five cylindrical beads 2.5 to 4.6 mm. in diameter and 1.2 to 2.5 mm. thick.

One cylindrical bead, 2.5 mm. in diameter and 0.8 mm. thick, appears to be made of serpentine.

A bead fragment and a partial cubical bead of turquoise 6 mm. wide and 4 mm. thick complete the bead inventory.

Stone Inlay

One small piece of turquoise, ground to a quarter circle, is probably a mosaic component. It is approximately 4 mm. long on either side and 1 mm. thick.

Stone Pendants

Pendants made of stone include two argillite specimens and one of serpentine. The smaller pendant of argillite appears to be unfinished, subpentagonal in outline, and is only partly drilled at one apex. It is 16 mm. long, 16 mm. wide, and 3 mm. thick. The larger argillite spedimen, which is half of a broken trapezoid, is 18 mm. long and an estimated 26 mm. wide and 2.5 mm. thick. It is split longitudinally through the top-centered suspension hole. The serpentine pendant is roughly subrectangular in form and has an off-centered drill hole. It measures 9.5 mm. in length, 6 mm. in width, and 3 mm. in thickness.

Miscellaneous Ground Stone

One hundred ninety-five pieces of ground stone are too fragmentary to classify. About 54 percent of the specimens are sandstone, 35 percent vesicular basalt, 6 percent fine grained basalt, and the rest limestone. Several of the vesicular basalt specimens are stained in yellow, green, and red hues.

OTHER LITHIC MATERIAL

Hammerstones

Stones used essentially for battering purposes can conveniently be divided into three classes: large elongated hammerstones, core hammerstones, and cobble hammerstones.

Large, elongated hammerstones. Two basalt specimens are approximately 20 cm. long, 9 cm. wide, and 8 cm. thick. These elongated hammerstones appear to have pecked hand grips near the midsection. The ends and ridges are darkened or stained, apparently from use.

Core hammerstones. Four core hammerstones of basalt are 5 to 7.5 cm. long, 4.5 to 6 cm. wide, and 4 to 6 cm. thick.

Cobble hammerstones. The majority of the hammerstones are unmodified basalt cobbles. These total 20 specimens that range from 6.3 to 10.8 cm. in maximum dimension. One fragmented quartzite cobble also belongs in this class.

Pebble Pounder

The entire perimeter of a spheri pebble, 3 cm. long, 2.7 cm. wide, and 1.8 cm. thick, is pitted, providing evidence of use as a pounding stone.

Minerals

Thirty-four non-ornamental worked pieces of mineral and 183 unworked pieces have been identified. The worked minerals include specimens of argillite, azurite, gilsonite, halite, hematite, quartz, talc, and turquoise. Hematite is the most commonly worked mineral, with 24 examples. The unworked minerals include, in addition to all of the above listed minerals, specimens of calcite, gypsum, specular hematite, limonite, magnetite, malachite, schist, slate, thenardite, and some unidentified minerals. A rare earth mineral from the vicinity of Death Valley and possibly augite are represented by the unclassified specimens. Most of these minerals are locally available or are at least within the range of the Verde Valley. Some of the other types, such as the Death Valley minerals, indicate an extended trade network.

Fossil Brachiopod

The fossil remains of an invertebrate bivalve shell found in a small pebble have been identified as those of a Spiriferid brachiopod of undetermined age. The specimen was recovered from the Tuzigoot Horizon.

Travertine Fossil

A fragmentary plant fossil was recovered from post-occupation sediments above the bench area. The fossil appears to be part of a leaf encrusted in travertine, but is not really complete enough for a positive identification. Leaf fossils are common in a travertine deposit 10 air miles to the northeast of the cave site, which is the most likely source from which this fossil may have been collected.

Chapter IV

POTTERY AND CLAY ARTIFACTS

POTTERY

Pottery classifications are based primarily upon the published descriptions provided in the Pottery Types of the Southwest Ceramic Series, edited by Colton (1955; 1956; 1958), and the Handbook of Northern Arizona Pottery Wares by Colton and Hargrave (1937). Cibola White Ware and White Mountain Red Ware pottery classifications rely heavily upon descriptions from the Cibola White Ware Conference held at the Museum of Northern Arizona (1959) and on the published work of Carlson (1970), respectively. In addition to these sources, extensive use was made of the type collections of Northern Arizona University and those of the Museum of Northern Arizona.

Plainware Pottery Sherds

All of the 1,304 plainware sherds from grid square F8 were analyzed (Table 1). Roughly 99 percent of this stratigraphically controlled collection can be classified as indigenous Alameda Brown Ware pottery types. The remainder of the plainware sherds from all proveniences can be divided among six other pottery wares, including Mogollon Brown Ware, Prescott Gray Ware, Pimeria Brown Ware, Tusayan Gray Ware, Homolovi Orange Ware, and Winslow Orange Ware. Time and cost limitations prevented the analysis of Alameda Brown Ware pottery from other stratigraphically controlled grids.

Alameda Brown Ware. Verde Brown and Tuzigoot Plain are the dominant pottery types from Exhausted Cave. During the Honanki Phase, Verde Brown is the more abundant of the two. This relationship also holds true during the Tuzigoot Phase until near the end of the occupation at which time Tuzigoot Plain becomes the dominant type.

The next most common types of pottery are Verde Red and Tuzigoot Red. These are coated with a thin outer wash or slip and often have smudged interiors. The inferior type, Verde Red, diminishes in relative quantity at the beginning of the Tuzigoot Phase, consequently becoming even more subordinate to Tuzigoot Red, which remains more or less stable throughout the phase sequence. The overall effect wrought by this latter relationship is that the combined Tuzigoot types appear to assume a position of dominance over the combined Verde types with the onset of the Tuzigoot Phase.

Table 1

Plainware Pottery

	STRATUM								
	II	III	IVc	IVb	IVa	V	VI	VII	Totals
ALAMEDA BROWN WARE									
Verde Brown	9	87	124	150	54	12	18	60	514
Verde Red	3	21	13	21	8	1	3	7	77
Verde Smudged		3	7	6	1	1	1	3	22
Tuzigoot Plain	1	42	96	126	59	4	15	40	383
Tuzigoot Red	1	25	33	35	16	2	10	13	135
Tuzigoot Smudged		22	28	42	19	7	16	19	153
Sunset Red			1					1	2
PIMERIA BROWN WARE									
Wingfield Plain			4	1					5
PRESCOTT GRAY WARE									
Verde Gray				1					1
WINSLOW ORANGE WARE									
Tuwiuca Orange		1	1						2
Black Axe Plain		1	2	3	3		1		10
Totals	14	202	309	385	160	27	64	143	1304

Small quantities of Sunset Red and Smudged pottery types are present mostly in Tuzigoot Phase deposits in association with Jeddito Black-on-yellow pottery. These sherds differ in paste appearance from similar type sherds found above the Mogollon Rim in the Flagstaff area. In a few instances, the paste is more like that of the Tuzigoot pottery types.

Mogollon Brown Ware. There are only a few corrugated sherds of Mogollon Brown Ware from the site. Some of these found in the uppermost levels have been identified as Elden Corrugated pottery, but the others could only be classified as to pottery ware, based on the comparative collections at the Museum of Northern Arizona.

Prescott Gray Ware. The sherds of Prescott Gray Ware are too few to be of any significance except in determining that trade relations existed with the Prescott Branch.

Pimeria Brown Ware. Pimeria Brown Ware sherds have been further classified to type as Wingfield Plain. A trace amount of these sherds occurs in all levels of the cave deposits.

Tusayan Gray Ware. Tusayan and Moenkopi Corrugated jar sherds are scarce and generally occur in the later deposits. One sherd of Moenkopi Corrugated pottery together with one sherd of Walnut Black-on-white are of some value as temporal indicators since these are the only sherds found associated with the enclosed area of the work space outside the cave.

Homolovi Orange Ware. Homolovi Orange Ware is represented by a single specimen of Homolovi Corrugated pottery, which occurs in upper level post-occupational deposits.

Winslow Orange Ware. Sherds of Winslow Orange Ware are first recorded in early Honanki Phase deposits and appear to be well established by the late Honanki Phase. Both Tuwiuca Orange and Black Axe Plain pottery are present. The latter type is the more common in occurrence and, among the plainware sherds, is surpassed in quantity only by the indigenous Verde and Tuzigoot pottery types.

Decorated Pottery Sherds

The collection of 957 decorated sherds is especially significant in that it points out for the first time the relative importance of indigenous painted ceramics among the Southern Sinagua (Table 2) and also provides stratigraphic relationships for several of the lesser known pottery types (Table 3).

Table 2

Frequency Distribution of Decorated Pottery Types

Pottery Type	Percent
Tuzigoot W/R	23
Walnut B/W	13
Homolovi Poly	12
Jeddito B/Y	12
Tusayan B/W	4
Tuwiuca B/O	4
Flagstaff B/W	3
Verde W/R	3
Bidahochi B/W	1
Bidahochi Poly	1
Chavez Pass B/R	1
Holbrook B/W	1
Jeddito B/O	1
Sosi B/W	1
Tularosa B/W	1
Verde B/R	1
Tuzigoot B/R	1
Unclassified Tusayan W.W.	5
Unclassified Little Colorado W.W.	3
Unclassified Cibola W.W.	2
Unclassified Jeddito Y.W.	2
Unclassified Tsegi O.W.	1
Unclassified White Mountain R.W.	1
All Other Pottery Types Combined	3
	100

Table 3

Decorated Pottery

	I	II	III	IVd	IVc	IVb	IVa	V	VI	VII	Totals
ALAMEDA BROWN WARE											
Verde W/R			1	1							2
Verde B/R			1								1
Verde Poly				1							1
Tuzigoot W/R		1	5	2	3	3	3			2	19
LITTLE COLORADO WHITE WARE											
Holbrook B/W				1	1		1				3
Padre B/W			1								1
Walnut B/W	2		3	2	6	2	1	1	2	1	20
Unclassified		1	3		1						5
TUSAYAN WHITE WARE											
Flagstaff B/W			1		1						2
Tusayan B/W			2		1		1		1		5
Unclassified			2	1	4		1				8
CIBOLA WHITE WARE											
Puerco B/W							1				1
Kokop B/W					1						1
Unclassified					1		1				2
TSEGI ORANGE WARE											
Jeddito Poly				1							1
Unclassified			1			1					2
WINSLOW ORANGE WARE											
Tuwiuca B/O		1	4				1	1	1		8
Chavez Pass B/R										1	1
Homolovi Poly				1	3	3					7
JEDDITO YELLOW WARE											
Jeddito B/Y				3	3	2	2		2	1	13
Bidahochi Poly							1				1
Unclassified				1			1				2
Totals	2	3	24	14	25	11	14	2	6	5	106

Alameda Brown Ware. In the sherd collection from Exhausted Cave, there are white-on-red, black-on-red, and polychrome varieties of Verde and Tuzigoot pottery.

Tuzigoot White-on-red, which comprises 23 percent of the decorated sherds, is by far the dominant painted pottery type for both the Honanki and Tuzigoot Phases. It occurs in quantity in all areas of the cave, but is most abundant on the raised platform area within the cave and in the work area outside the cave. Both bowl and jar sherds are represented, with approximately 80 percent jar sherds. Generally speaking, the designs are executed only on the exterior of the vessels. The design motifs consist of dots patterned in random clusters or in rows and columns, lines with curvilinear or angled pendant hooks, lines with pendant hooked triangles, ticked lines or lines with offset ticking, parallel lines, and triangular scrolls. Sherd illustrations are on file along with the pottery collections at the Museum of Northern Arizona.

Sherds of Verde White-on-red occur infrequently and assume a spatial and temporal distribution pattern similar to that of the Tuzigoot White-on-red pottery. The specimens represented by this collection are all jar sherds, with only exterior decoration. The designs on Verde White-on-red sherds generally conform to the Tuzigoot White-on-red style. Parallel line, ticked line, double scalloped line, and pendant hooked line motifs are prevalent.

Black-on-red sherds representing Verde and Tuzigoot pottery types are scarce. These decorated types commencing with the Honanki Phase are too few to indicate a definite horizontal distribution pattern. Although the sample is small, the design motifs consist of parallel lines, solid elements, and diagonal hatched lines.

The polychrome sherds of Verde and Tuzigoot pottery are even more scarce than the Black-on-reds. The few sherds of each type in the collection show black and white designs on a red background. Hatched motifs are bordered by a white line in two instances, and the other motifs are indistinguishable. Only three sherds of Verde Polychrome and one of Tuzigoot Polychrome were present. They were found in Tuzigoot Phase deposits only.

Mogollon Brown Ware. Three pieces of Elden Corrugated pottery were decorated. These red-on-buff colored sherds occur in post-occupational strata within the cave. They co-occur with the previously mentioned Elden Corrugated sherds and may be part of a single decorated vessel.

Prescott Gray Ware. Only two sherds of Verde Black-on-gray were recovered. The characteristic simple geometric designs of this pottery type are similar to those found on the Tuzigoot and Verde White-on-red pottery types.

Little Colorado White Ware. This important ceramic ware includes several pottery types, all of which are represented in the sherd collection from NA10,769. Walnut Black-on-white is the second most common of the decorated pottery types and accounts for 13 percent of the total of the painted sherd assemblage. It occurred in every level and area of the site, although it was distributed primarily in the interior living area and outside work area of the cave. Small quantities of Holbrook Black-on-white, Padre Black-on-white, and Leupp Black-on-white were also found. No particular distribution patterns were noted for these types.

Tusayan White Ware. Tusayan White Ware is ranked number five in abundance among the decorated pottery wares. Tusayan Black-on-white and Flagstaff Black-on-white are the dominant pottery types within this ware. Both of these types appear to be fairly evenly distributed among the different areas of the cave, with Tusayan Black-on-white being the more plentiful of the two during the Tuzigoot Phase. Minor quantities of Sosi Black-on-white, Kayenta Black-on-white, and Bidahochi Black-on-white round out the types representing this pottery ware. It may be significant to note that most sherds of Bidahochi Black-on-white occur at the very end of the cave's occupational sequence. A few sherds of this latter type occurring in earlier levels had definitely been displaced due to rodent activity.

Cibola White Ware. Cibola White Ware is another late comer. Several types, including Puerco Black-on-white, Reserve Black-on-white, Tularosa Black-on-white, Pinedale Black-on-white, and Kokop Black-on-white, make their appearance during the Tuzigoot Phase. The majority of Cibola White Ware sherds are Tularosa Black-on-white, a late occurring pottery type. The ware is seemingly evenly dispersed throughout the site area.

Tsegi Orange Ware. The Tsegi Orange Ware collection consists of sherds of Tusayan Black-on-red, Tusayan Polychrome, Jeddito Black-on-orange, and Jeddito Polychrome. This ware occurs sparingly in Honanki and Tuzigoot Phase sediments in all the areas of the site.

Winslow Orange Ware. Winslow Orange Ware is of particular interest to the present study. Since there is no conclusive tree-ring data available for any of the pottery types within the ware, the stratigraphic relationships obtained from this excavation offer at least a reliable source for accepting a relative chronology. The Winslow Orange Ware pottery types occurring at Exhausted Cave include Tuwiuca White-on-orange, Tuwiuca Black-on-orange, Homolovi Black-on-red, Homolovi Polychrome, Black Axe Polychrome, Chavez Pass Black-on-red, and Chavez Pass Polychrome.

The only pottery type of this ware which occurs in Strata II and III, the early and late Honanki deposits, is Tuwiuca Black-on-orange.

The Homolovi and Chavez Pass Black-on-red pottery types are introduced in Stratum IV during the Tuzigoot Phase at which time the polychromes also appear.

Twelve percent of the decorated sherds are of the Homolovi Polychrome type, and only a handful of sherds have been identified as Black Axe Polychrome. A single sherd of Chavez Pass Polychrome was collected. There is meager evidence that Homolovi Polychrome may supersede the introduction of Jeddito Black-on-yellow pottery. This evidence comes from Grid Square B7 in the bench area where a large roof collapsed on 70 cm. of fill, thus providing protection against rodent disturbance. In Square B7, Homolovi Polychrome occurs 20 cm. above the bench in association with Jeddito Black-on-orange. Jeddito Black-on-yellow is present at 40 cm. and Bidahochi Polychrome at about 50 cm. above the bench. This would seem to be a logical sequence; and, even though there is an unsubstantial quantity of sherd material present on which to base any absolute conclusion, it can be considered as a tentative succession.

Winslow Orange Ware pottery seems to be fairly equally distributed among the site areas.

Jeddito Yellow Ware. Jeddito Yellow Ware is the fourth ranked major pottery ware at NA10,769. Jeddito Black-on-yellow is the primary type of this ware and is as profuse as the Homolovi Polychrome pottery type. It is confined to Tuzigoot Phase deposits and exhibits a uniform areal distribution pattern. Sherds of the other two pottery types of this ware, Bidahochi Polychrome and Hukovi Polychrome, are few in number and occur only near the termination of the occupation period.

White Mountain Red Ware. Pinedale Black-on-red and Pinedale Polychrome sherds indicate further trade relations developed just prior to the abandonment of the cave. The few sherds of these types seem insignificant in quantity, but are undoubtedly important in determining possible influences affecting abandonment of the site location.

Hohokam Buff Ware. A lone sherd of Santa Cruz Red-on-buff comes from the bench area Tuzigoot Horizon. It undoubtedly was brought into the cave from one of the Cloverleaf or Camp Verde Phase sites which are so numerous on the lower terraces and flats below the site.

Mesa Verde White Ware. One sherd of Cortez Black-on-white from post-Tuzigoot Horizon deposits was found inside the cave. As was the case with the Hohokam pottery sherd, this specimen was probably from an earlier site in the proximity of the cave and may represent the southernmost penetration of Mesa Verde pottery during Pueblo II times.

Restorable Vessel

A partially restorable Tuzigoot Red jar (Fig. 10) with a maximum diameter of 34 cm. and a mouth diameter of 22.3 cm. was recovered from Cist 2, an early Honanki Phase floor feature. The jar is presently 24.5 cm. high and is estimated to have been between 26 and 30 cm. in height in its original condition. It has a pronounced gila shoulder and bulged bottom. The quantity of tempering material in this specimen is somewhat excessive, but is within acceptable limits for the Tuzigoot pottery type, which often takes on the abundant temper characteristic of the Verde pottery types. An outer coating of soot and considerable wear on the interior bottom of the vessel indicate that the jar was used primarily as a cooking vessel. No other complete or restorable vessels were found in association with the cave.

Sherds of Unusual Pottery Forms

Sherds of uncommon and extraordinary vessel forms which merit special recognition are of two basic types. Fragments of miniature vessels form one category, and the second category is composed of a single sherd from a lipped jar.

Figure 10. Shouldered Tuzigoot Red Cooking Jar

Miniature vessels. There are a dozen sherds in the pottery collection which are derived from miniature vessels. These sherds are mostly akin to the Tuzigoot pottery type and have a high incidence of non-painted surface decoration. Typical surface treatments include fingernail impressions, perforations, and engraved designs. Identifiable rim pieces indicate that bowl forms are predominant among the miniature vessels, but at least one miniature jar is also represented, bearing a slight resemblance to a shouldered seed jar.

Lipped jar. The lipped jar is a rare item among Southwestern archeological site collections. Lipped jars are, according to Kidder (1966:202), vessels with an inner lip near the mouth on which rests a cover or lid, as with a modern teapot. Evidence of local manufacture of one such vessel is provided by a single Verde Brown sherd. The sherd was found in deposits overlying the Tuzigoot Horizon, rendering it impractical to assign the object to a specific time period.

Fabric Impressed Pottery

The inner faces of nine sherds of Alameda Brown Ware show impressions left by fabric wrapped anvils at the time of their manufacture. Where clear impressions were left, it was possible to identify the particular weave pattern of the fabric. In all cases, the fabrics proved to be of the plain weave type. The majority of these specimens are of the Tuzigoot pottery type with only two exceptions of Verde Brown.

Ladles and Dippers

Evidence of ladles and dippers suggests that such artifacts were not common among the cave's inhabitants. Four pieces of ladle handles representing Jeddito Yellow Ware, Tsegi Orange Ware, Tusayan White Ware, and Alameda Brown Ware were found. One fragment of a Tuzigoot Red dipper was present. Ladles were probably present during both the Honanki and Tuzigoot Phases, and the dipper is associated with the Tuzigoot Horizon.

Figurine (?)

A possible animal effigy is represented by a broken cylinder with three knobs on one end. The object has a hole through its longitudinal axis, and two of the knobs are set close together giving the effect of ears and a snout, but it may just as well be some sort of leg or handle of a vessel. It post-dates any of the occupational periods.

Worked Sherds

A total of thirteen worked sherds of Alameda Brown Ware and one of Jeddito Black-on-orange were found in Tuzigoot Phase deposits. Six of these specimens, including the one decorated sherd, have ground edges but are too fragmentary to classify beyond the category of worked sherd.

One large Tuzigoot Plain sherd appears to have been used as a scraping implement.

The remaining seven sherds are all disks, and four have ground edges and holes drilled through their centers. The other three disks are rough-shaped and may be preforms of the former type disk, as one shows evidence of grinding along a short section of its edge.

MISCELLANEOUS CLAY ARTIFACTS

Fired Clay Objects

Two small pinched clay objects were recovered from Tuzigoot Phase deposits. Both objects are highly irregular in shape and show finger indentations. Neither could be identified as to pottery type, but they approximate the paste and temper characteristics of the miniature vessel fragments.

Unfired Clay Objects

An oval and a flattened lump of clay were found in the fill overlying the bench area inside the cave. The oval specimen may be a gaming piece, but its durability due to the softness and the crumbling nature of the clay is definitely a factor to be considered in such an interpretation. In addition to the aforementioned objects, two clusters of bits of raw clay were recovered in the Tuzigoot Phase fill.

Clay-Based Mineral Blocks

Two mineral-bearing blocks of clay are associated with the medicine bundle from Cache 1. These blocks undoubtedly served as a convenient means of storing ready-to-use pigment. A brilliant red stain can be obtained by merely wetting one of the blocks. For a more complete description of the component artifacts of the medicine bundle, refer to the Cache section of this report.

Raw Clay

Several chunks and bits of raw clay were obtained from the ceiling cache (Cache 2) over the cave's inner bench. The purpose of storing raw clay is unknown; the fact that it was put into the cache and the cache contained seed would, however, seem to imply that it was either intended for a special use of its own at a future date or perhaps that it was in some way functionally related to the seed storage process per se.

CERAMIC DATING

The duration for the occupation and utilization of Exhausted Cave spans a period of approximately 200 years (Fig. 11). The pottery found in the earliest level of the cave consists of only two sherds of Walnut Black-on-white. It is, therefore, necessary to examine the total assemblage for a more meaningful interpretation of the floor level and overlying sterile depositions. A full range of Little Colorado White Ware pottery types is apparent, coinciding with a nearly complete Pueblo III Tusayan White Ware assemblage. Black Mesa Black-on-white is noticeably absent from the latter ceramic ware which may indicate an initial occupancy beginning sometime after A. D. 1120 or 1130.

A non-utilization period seems to have followed the earliest tenancy and activity within the cave was not resumed until about A. D. 1250. Presumably, this period witnessed either a permanent or intermittent use of the surrounding areas. Holbrook Black-on-white, Padre Black-on-white, Sosi Black-on-white, Flagstaff Black-on-white, and Tusayan Black-on-red are pottery types found in deposits post-dating A. D. 1250, but which represent this intervening period.

At about A. D. 1250, Winslow Orange Ware is first introduced. Both utility and painted types of this ware are present in the uppermost component of Stratum II, accompanied by Tuzigoot White-on-red. In Stratum III, the ware is firmly established along with such pottery types as Tusayan Black-on-white and a persistent Walnut Black-on-white.

In the bench area beneath the roof collapse, there is some indication that Homolovi Polychrome and Jeddito Black-on-orange are next on the scene. These pottery types appear in that particular area of the cave to be stratigraphically inferior to Jeddito Black-on-yellow, which makes its debut in Stratum IVc. All three of these types

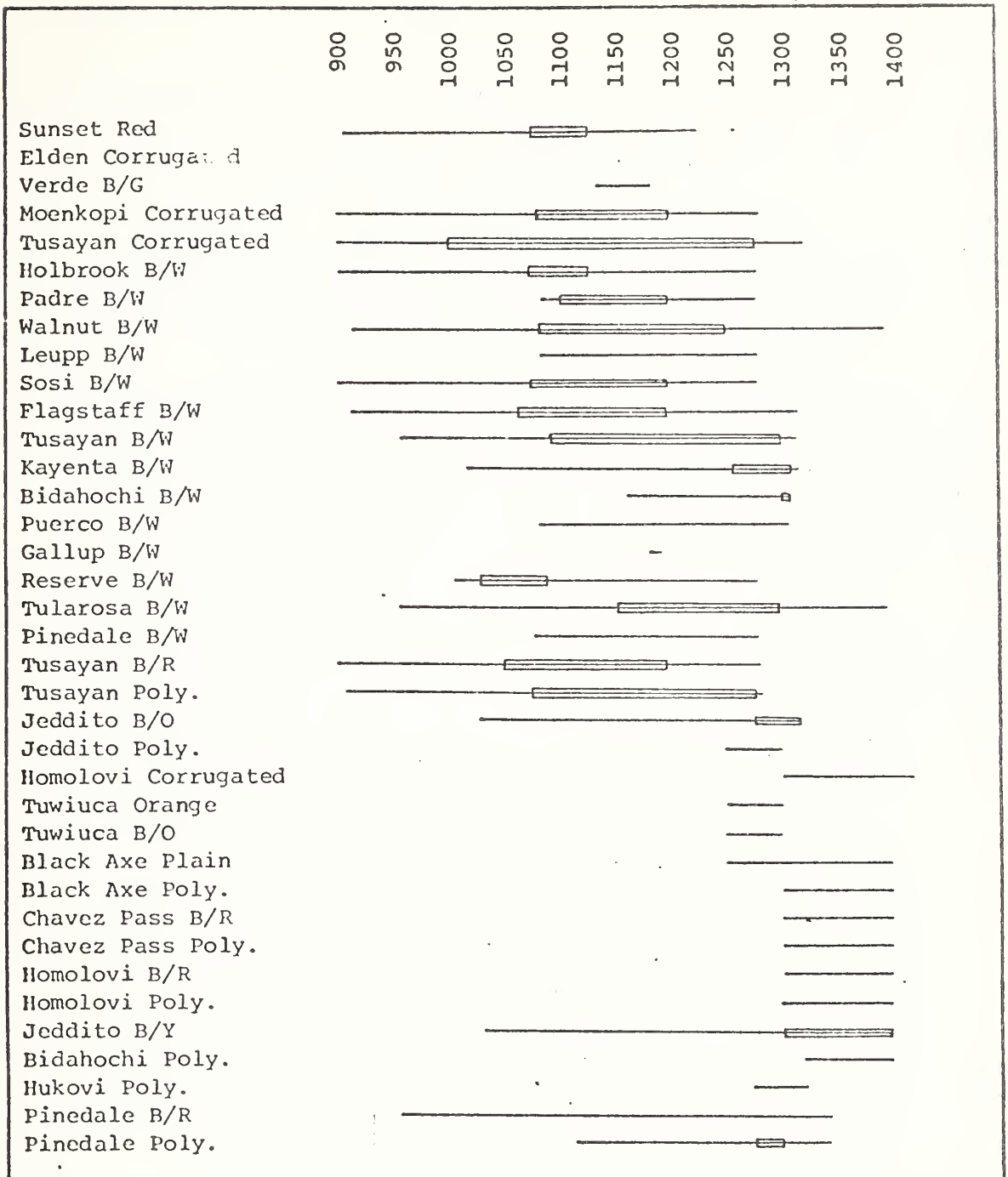

Figure 11. Temporal Ranges of Certain Pottery Types from Exhausted Cave, Based on Ceramic and Tree-Ring Correlations Established by Breternitz (1966). The Heavier Horizontal Lines Represent the Period of Greatest Abundance for a Given Pottery Type; the Thin Horizontal Lines Indicate the Type's Full Time Range.

co-occur in the other areas of the cave and appear to be restricted to Stratum IV deposits. A significant increase in sherd quantity and variety of types of Cibola White Ware is noted at about the same time as the Jeddito Black-on-yellow pottery makes its presence known.

No significant changes occur in the pottery assemblage until Stratum IVa is reached. Bidahochi Polychrome is present by this time, and probably Bidahochi Black-on-white is there also. Gallup and Tularosa Black-on-white types still persist.

The latter part of the occupation is characterized by the introduction of White Mountain Red Ware pottery. Pinedale Black-on-red and Pinedale Polychrome mark the ending period of the cave's cultural history. The presence of only a small quantity of White Mountain Red Ware and lack of late polychrome types such as Tonto Polychrome, Gila Polychrome, and Sityaki Polychrome suggests a terminal date of about A. D. 1320, as indicated on the chronology chart.

To summarize, it would appear that the ceramic evidence indicates that the combined Strata I and II date from A. D. 1120 or 1130 to about A. D. 1250; Stratum III from A. D. 1250 to A. D. 1275 or 1300; and Stratum IV from A. D. 1275 or 1300 to A. D. 1320.

Chapter V

PERISHABLES

BONE AND SHELL ARTIFACTS

A very small quantity of bony artifacts and a large quantity of shell artifacts were recovered.

Bony Objects

A total of four pieces of worked bone, a turtle shell carapace, and several antelope hooves constitute the entire collection of bony artifacts.

Worked bone. Three of the specimens of tooled bone are fragmentary artifacts made of splinters of deer bone. One of them is a 5 cm. long pendant shaped object with a biconical hole drilled near its tapered end. The other two broken pieces are less than 3 cm. long and show evidence of grinding on one end. The remaining specimen is a modified femur of an unidentified small mammal the size of a ring-tail cat. The distal end of this bone has been cut off and it is otherwise unaltered. The total length of this object is 5.6 cm. All four specimens are presumably Tuzigoot Phase artifacts.

Turtle shell rattle. A complete Sonoran mud turtle carapace was found in Cache 1. Four small polished pebbles removed from within the shell suggest its use as a rattle. Modern pueblo peoples have been reported (Underhill 1944:126) to have cleaned the interior of turtle carapaces by placing stones inside and pulverizing the flesh loose. The stone openings of the shell were then plugged, and the stones would rattle inside the shell making a rhythm while strapped to a dancer's leg. Antelope hooves were sometimes attached to the turtle shell with leather fringe. This latter arrangement is depicted in Figure 12, less the actual ties.

Antelope hooves. Those antelope hooves illustrated in Figure 12 and three or four others are associated with Cache 1. They are probably a component of a dancer's outfit.

Shell Ornaments

Marine and fresh water mollusks were used extensively for manufacturing shell ornaments. Disk-shaped beads are considered as a separate category below.

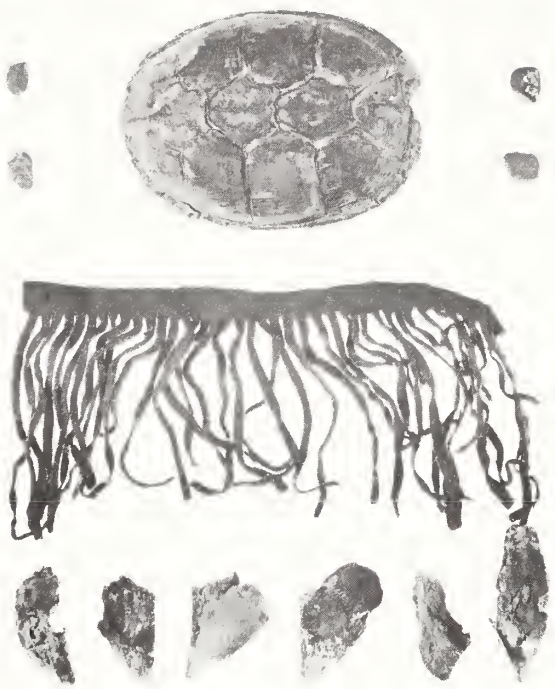

Figure 12. Turtle Shell Rattle from Cache 1

Marine shells. Types of mollusk shell represented include in order of abundance the following genera: Olivella, Glycymeris, Laevicardium, Conus, Nassarius, Tagelus, Ostrea, Pecten, and Haliotus.

Olivella, a small olivella-like species of Conus, and Nassarius shell beads in various stages of manufacture were found throughout the cave. The completed Olivella and olivella-like Conus beads were ground on the spire and aperture ends to facilitate stringing. The Nassarius shells were usually punctuated for stringing.

Rings, bracelets, and a pendant were manufactured from Glycymeris shell, and a larger species of Conus was used to make tinklers.

The remainder of these shells were all broken into small pieces and may be manufacturing debris, broken artifacts, or intended for mosaic work.

A single Conus shell bead and small quantity of Laevicardium occur in Honanki Phase deposits; otherwise, the marine shell artifacts were restricted to the Tuzigoot Horizon.

Fresh-water shells. The most abundant type of shell occurring at Exhausted Cave was that of an unidentified species of fresh-water clam. Pelecypod shell fragments were discovered in all parts of the cave in both late Honanki and in Tuzigoot Phase deposits. A few specimens of Pelecypod shell had been ground on their edges.

Discoidal shell beads. Unidentified types of shell were used to make tiny disk-shaped beads ranging from 3 mm. to 5 mm. in diameter and 0.9 mm. to 3.2 mm. in thickness. Fourteen of these beads are distributed in both Honanki and Tuzigoot Phase deposits. In addition, there is one bead blank from the Tuzigoot Horizon and an inlay piece from the Honanki Horizon.

Double-lobed bead. A double-lobed shell bead or pendant was recovered from the bench in the vicinity of a prehistoric rat's nest.

LEATHER AND FEATHER ARTIFACTS

Leather

The extraordinary artifacts made of leather are all from Cache 1. The inventory consists of a dessicated skin bag, two wrapped bundles, two pouches, and leather fringe.

Prairie dog skin and textile bag. A prairie dog skin, identified by residual hair, was used in the construction of a leather and textile bag. This damaged piece of skin (Fig. 13) is approximately 25 cm. long and 17 cm. wide. Three patches have been applied to the skin. These are sewn on with a two-ply, S-twisted sinew. A running stitch was used to sew on two of the patches, and a combination running stitch and overcast stitch was used on the third patch. The latter stitch was tied off with an overhand knot. The ties on the other patches could not be determined. There is also a tear along one edge which was mended by using an overcast stitch. Four dried out prairie dog feet were found with the bag, but it was impossible to determine if they had been a part of the skin or whether they were contained inside the bag. The fabric portion of the bag is discussed in the textiles section of this report.

Wrapped leather bundles. There are two wrapped leather bundles (Fig. 14a, e). The first bundle to be opened consisted of a 30 cm. long by 50 cm. wide L-shape strip of leather which flared out on one end to a maximum width of 12 cm. It had been doubled over in the middle, and the flared end was doubled over to form a kind of hood which held both ends in place. A thin piece of leather about a meter long made ten wraps around the bundle and was tucked in on one end. The inner face of the bundle appears to be padded with a soft batting-like material, possibly cotton. The contents of this bundle were two herbaceous stems and a piece of root.

The second wrapped bundle was made in the same general manner as the first bundle, but the flared end on this specimen served as the wrap. The strip was 25 cm. long and from 2 to 6 cm. wide. The flared end, which was approximately 30 cm. wide, was wrapped around the bundle two or three times and secured by tucking under. Some herbaceous root fragments were contained in this bundle.

Sewn pouch. A red hematite stain covers this small leather pouch (Fig. 14b). It is 12 cm. long and 5 cm. wide. The edges of the pouch are sewn in an overcast stitch with two-ply, S-twisted sinew. A grass leaf, a piece of cotton thread, pollen, meal, and plant fiber were contained in the pouch.

Small pouch. The corners of an irregular piece of leather were brought together and tied with a strip of leather to form this pouch (Fig. 14f). The stiffness of the leather prevented unwrapping to determine its dimensions and other characteristics. A small opening was made in the bulbous part of the pouch to examine its contents. Some soil, meal, and pollen were found inside.

Figure 13. Leather Portion of Bag, Cache 1.
Length is about 25 cm.

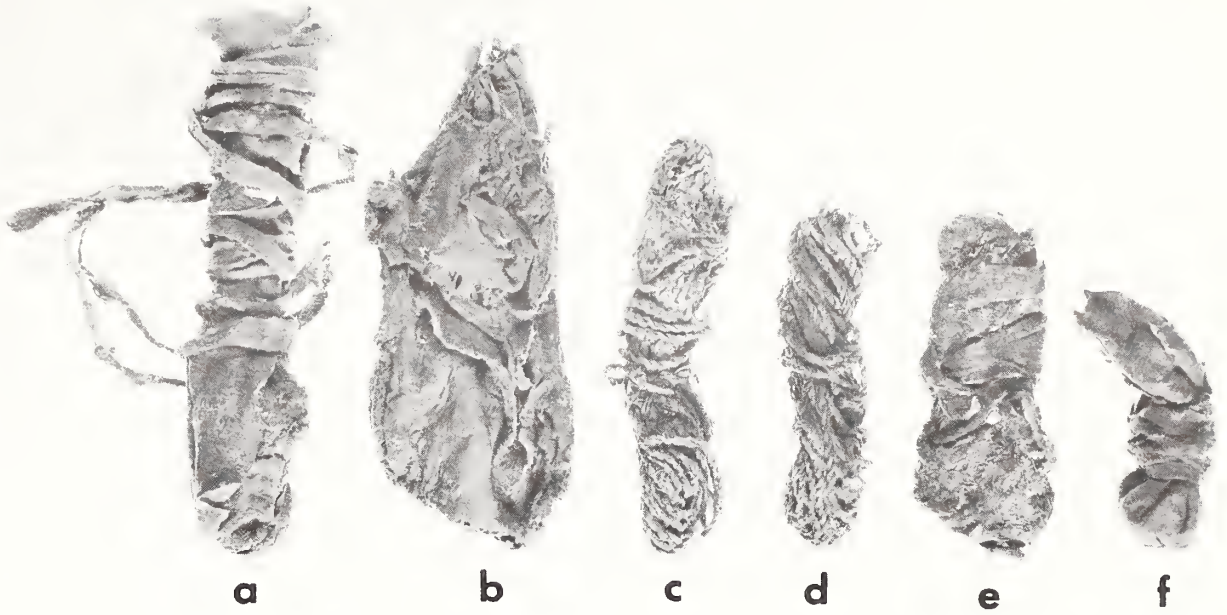

Figure 14. Bundles, Pouches, and Twine from Cache 1.
a and e, Wrapped Bundles; b and f, Pouches;
c and d, Twine Bundles. Length of a is 12.5 cm.

Leather fringe. Two pieces of leather fringe were found. The larger piece, in Figure 12, is 18 cm. long and the band and fringe together are 9 cm. wide. This specimen was most likely used in conjunction with the turtle shell and antelope hooves to join them together as a unit. The smaller fringe, nearly 10 cm. long and 5 cm. wide, is irregular in shape and is probably left over scrap material.

Feathers

Feather artifacts include two wild turkey feather bundles.

Feather bundles. Two feather bundles were salvaged. The larger and better preserved specimen was found lying directly on top of the bench area, beneath a small flat rock. The bundle consisted of seventeen loose turkey feathers and three turkey feather pahos, loosely bound with shredded juniper bark coils. It was 14.5 cm. long and 2.7 cm. in diameter. The individual pahos were constructed of three to six feathers each tightly bound at their proximal ends with sinew wraps. The pahos ranged from 9 cm. to 13 cm. in length.

The second feather bundle was found in Cache 1 and consists of a cluster of packed feathers. There was no evidence of a wrap or tie around the bundle. The overall dimensions of this bundle, prior to its disassembly for identification of feather types, were 11.2 cm. in thickness. These feathers were also classified as wild turkey.

LEAF, GRASS, AND WOODY ARTIFACTS

Leaf and Grass Artifacts

There are a variety of woven objects, interesting grass artifacts, ties and knots, and just plain chewed fibers contained in this artifact grouping. These are assigned to the Tuzigoot Phase unless stated otherwise.

Sandal. The remains of a plaited cord sandal were found near the mouth of the cave. The weave is an over-two, under-two twill pattern, and the material is yucca fiber. Kent (1954:51) reports a similar specimen from Montezuma Castle, and Haury (1934:65,66) discusses finds of this type sandal at Rarick Creek, Clear Creek, Tonto National Monument, and the Canyon Creek Ruin. Twilled sandals are also mentioned from Kinisba (Cummings 1940:69).

Matting. One small fragment of matting (cf. sotol) is woven in an over-one, under-one pattern. The piece is 7 cm. long and 4 cm. wide with individual strands 1.2 cm. in width.

Braided yucca. Objects of unknown use crop up occasionally in the artifact assemblage. An irregularly shaped two-strand flat braided object found on the bench fits into just such a category. It is about 5 cm. long and 2 cm. wide. Split broadleaf yucca was used in its construction.

Pot rest. Bunches of grass were gathered together and partially twisted in a neat coil to make this simply constructed pot rest. The finished product is 20 cm. in diameter. Several species of grass and morning glory (Ipomoea coccinea) stems are included. The various grasses represented are lovegrass (Eragrostis intermedia), panicum (Panicum capillare), and either dropseed (Sporobolus sp.) or muhly grass (Muhlenbergia sp.).

Wrapped grass. A small bundle of wrapped grass 4.5 cm. long and 1 cm. in diameter is a fascinating artifact which offers no clues whatsoever as to its function. An unidentified type of grass is wrapped with beargrass. The wrap consists of a single strand of beargrass coiled the entire length of the bundle and tucked on itself at both ends.

Binding loops. Two yucca leaf binding loops and one beargrass loop were recovered from the bench area. The yucca specimens are both made of a single strand of split leaf. One of these consists of only one loop and the other makes three complete loops. Both are tied off on their ends with square knots. The beargrass loop is of two-strand or paired construction and also has square knots on either end which hold the strands together. A 5 cm. diameter seems to be the preferred size for these loops. Four-ply cord loops are described in the cordage section.

Coils. An isolated specimen of broadleaf yucca was found on the bench. Other coils occur with leather and feather artifacts.

Ring. A possible ring made of a two-ply, S-spun, Z-twisted bast cord is mentioned here since it is not the typical sort of cordage artifact.

Knots. Seventeen examples of yucca reef or square knots were found. Only one of these appears to be derived from Honanki Phase deposits. Narrowleaf yucca is the common base material. A few of the leaves are shredded, but were not twisted as in cordage. Another knot

specimen is a broadleaf yucca consisting of two reef knots and three overhand knots on a single split leaf. An isolated example of a granny knot was found on the bench near a rat's nest. It is made of untwisted yucca fiber.

Quids. Numerous quids were found in the bench area. Most are less than 3 cm. in length, but at least one specimen was in excess of 6 cm. Yucca seems to be the primary source of these artifacts.

Woody Artifacts

Items made of wood and woody plant materials are mostly utilitarian and relate to subsistence and weaving technologies.

Self-bow. The remains of a hardwood bow (Fig. 15a,b) were recovered from the upper strata near the rear portion of the cave. The wood belongs to the Salicaceae family. The two shaped segments were originally part of the same object. One fragment is 16 cm. long, 2.7 cm. wide, and 1.9 cm. thick. The other specimen is 10 cm. long, 2.7 cm. wide, and of undetermined thickness. The sapwood occurs on the outer or convex face; the heartwood is on the inner or concave face. This construction allows for a maximum tensile strength.

Arrow shafts. Common reed (Phragmites communis) was used in the manufacture of these artifacts.

Neither of the two specimens (Fig. 15d,e) are complete. One is 17 cm. long and 0.7 cm. in diameter. It has a notch on one end near the node. The other arrow shaft is 22 cm. long and 0.8 cm. in diameter. It is cut off and reamed at the node on one end.

Tapered stick. A broken tapered stick (Fig. 15f) was found on the cave bench. It is presently 13.2 cm. long and tapers to a rounded point on the intact end. Transverse grooves on the tapered end indicate that this object has been wedged into another object. The shaft diameter is 0.6 cm., and it narrows to about 0.4 cm. on its pointed end. The groove marks and tapering suggest its possible use as an arrow foreshaft.

Shed separating tool. This tool (Fig. 15c) is similar in appearance to the tapered stick noted above. The complete specimen is 32.4 cm. long and 5 cm. in diameter. It has a slight taper toward one rounded end and is squared off on the opposite end. The nodes have been smoothed, and the entire stick has a sheen or polished look to it.

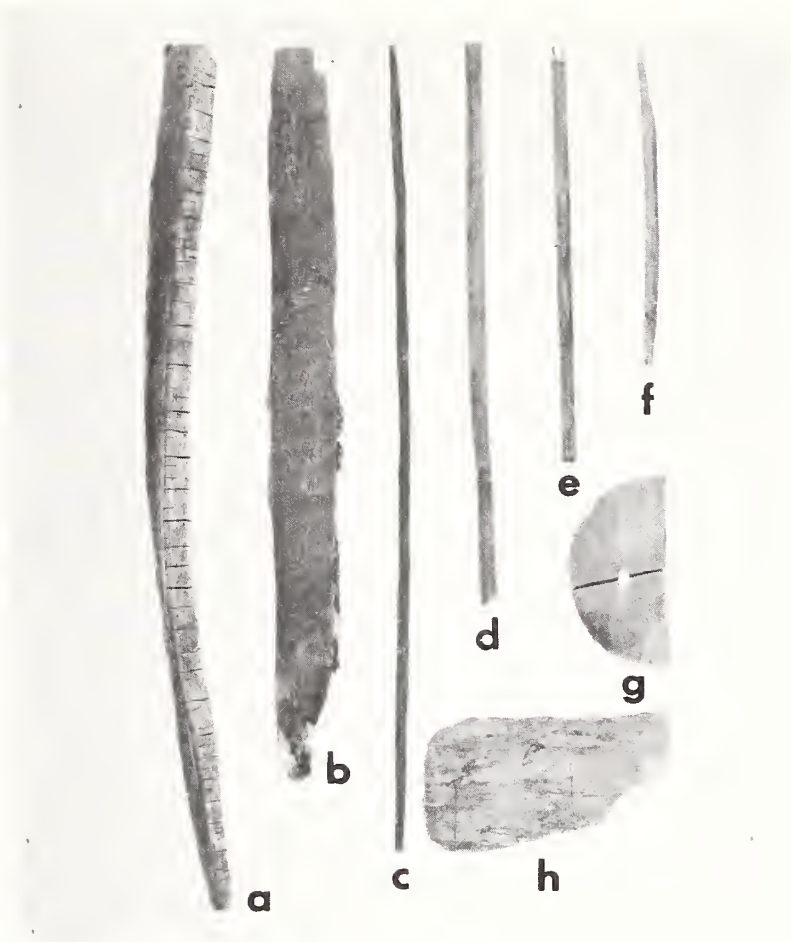

Figure 15. Woody Artifacts from Exhausted Cave.
a and b, Self Bow; c, Shed Separating Tool;
d and e, Reed Arrow Shafts; f, Tapered Stick;
g, Spindle Whorl; h, Batten.
Length of a is 16 cm.

There are very light transverse striations at the tip end. Alfred Whiting (personal communication, 1973) has suggested that the object was used as a shed separating tool for weaving.

Batten. An irregularly shaped flat piece of cottonwood (Fig. 15h) probably functioned in the weaving process as a batten. It is 10 cm. long and attains a maximum width of 5.5 cm. The margins of the tool have been ground or worn smooth. The lateral margins are tapered providing a bifacial working edge. A batten specimen shaped similarly to this one is reported by Kent (1957:473, Fig. 3).

Spindle whorl. Half of a wooden spindle whorl (Fig. 15g) was recovered. The cottonwood specimen measures 7.8 cm. in diameter and is 0.5 cm. thick. There is a groove extending from the center hole to the beveled outer margin and about midway along the groove there is a second ovoid hole. The purpose of the groove and auxiliary hole remains to be determined.

Comb. A modified century plant stem with tooth-like serrations on one end is thought to have been used as a weaving comb. The object is 5.7 cm. long and 4 cm. wide. The serrated end has been thinned and the opposite end is cut square. It is worn considerably on either face of the serrated end.

Needle. A century plant spine 7 cm. long was undoubtedly used as a needle. The end opposite the point is shredded in typical needle fashion (Kent 1957:489).

Stripped devil's claws. Eight beaks of devil's claw were found that had been partially or wholly stripped of their outer skin. The tip end of one specimen has been tied with an overhand knot. No artifacts were recovered in which the removed strips had been used. Nevertheless, it may be assumed that the material was used to make some perishable objects. Basketry manufacture would be the most likely use to which devil's claw strips might be applied. Modern day Indians frequently add them to their baskets as decorative elements (cf. Pima, Papago basketry).

Worked stems. Two problematical worked stems were found. There is evidence of fire treatment on both specimens. One is a large hardwood stick 63 cm. in length which is burned on one end and pointed on the other end. The pointed end of this object is glossy indicating considerable wear, probably related to working a soft material. It may be a digging tool, but this seems unlikely due to the type of wear. The second stem is pointed on the burned end and

broken off at the opposite end. It is 8 cm. long and 0.9 cm. in diameter. One possibility is that this stem represents a fire drill. The origin of the woody material of which the latter specimen is made was not recognized.

Split wood objects. Two small wooden objects recovered from the bench are unusual artifacts. The first of these is a 6 cm. long hardwood splinter with bark attached. There is a coil of beargrass wrapped three times around the splinter and tucked in on itself. A hackberry leaf is held by the coil on the inner face of the splinter. This might be some kind of paho. The other specimen is an outer splinter of juniper. It is about 10 cm. long and is twisted and coiled. There are no clues as to its possible use.

Perforated gourd pieces. There are two irregular pieces of gourd from the bench deposits with angular perforation holes in them. The holes are arranged in a linear pattern. The larger piece is 5.5 cm. long, 4.5 cm. wide, and is somewhat rectangular in shape. It is ground on one edge. The other piece is about the same size, but is quite irregularly shaped. The angular holes suggest that a spine needle may have passed through the rind. Something may have been sewn to these gourd pieces, but there were no definite close associations of any other material.

BAST AND COTTON ARTIFACTS

Artifacts made of fibrous plant materials include batting, threads, cords, and textiles. Cotton and bast supplied the fiber to make these articles, most of which were found in the two storage caches and in the prehistoric packrat nest located on the cave bench. Cordage and textile specimens from Cache 1 are badly decomposed due to repeated exposure to moist air and water. Those items made of plant fiber which were deeper into the cave and protected from weathering have endured the years without much decay; but, unfortunately, these specimens received considerable damage from rodents. There is even good reason to believe that the cordage and textile specimens found in the prehistoric rat's nest are originally from Cache 2 and that this particular rodent is primarily responsible for vandalism to the cache. The mummified body of the packrat was found beneath a large fallen roof spall still clutching a textile specimen, similar to specimens from Cache 2, in its mouth. The artifacts, mostly remnants, are described below using Kent's (1954; 1957) terminology and classifications. Variations in the usage of some terms is explained in the appropriate contexts.

Batting

A fine batting material, probably cotton, was found lining the insides of two leather pouches from Cache 1. Details concerning the nature of the pouches are provided in the section describing the cache contents. Basically, the layer of batting served as cushioning material to protect fragile plant parts contained in the pouches.

Threads

Threads or continuous single plys of twisted fiber are made of two basic materials, bast or wild vegetable fiber and cotton fiber.

Bast threads. Numerous small pieces of bast thread were found. A typological analysis of the thread spins shows that an overwhelming majority of the specimens are Z-spun, which is interesting from the standpoint of attempting to determine the origin of the threads. Bast cordage threads usually are S-spun, whereas the weft and warp threads used in weaving are either S-spun, as in rag weft, or Z-spun, as in plain weave bast textiles. This observation strongly suggests the possibility that most of the thread pieces are derived from plain weave textile artifacts. Kent (1957:478) notes that bast cordage made of yucca fiber is generally always S-spun and that loom woven cotton articles are usually Z-spun (Kent 1957:476). There is no mention by Kent of the spinning technique or base materials most used in the construction of bast textile threads. The present assemblage of bast threads appears to consist mostly of perhaps flax or apocynum.

Cotton threads. Fragments of cotton thread, mostly from Cache 2 and the prehistoric rat's nest, are even more plentiful than the bast threads. These threads are without exception Z-spun. The bulk of the specimens found in Cache 2 are a brownish-gray color. Threads identical to these occur in scraps of brownish-gray plain weave textile, also found in Cache 2. A similar situation exists for brown and charcoal threads recovered from the rat's nest, where very tiny pieces of matching textile were found. This leaves little doubt that most of the loose cotton threads originally belonged to textile artifacts.

Cordage

The term cordage is used herein to refer to two-ply bast string or twine, cotton string or yarn, and cords of either material which consist of more than two threads or plys. Rope or heavy cord is included as a separate category of cordage.

Bast cordage. The greater percentage of bast cordage is made up of two-plys of S-spun thread which are Z-twisted together to form a durable strand of twine. Two tightly wrapped bundles (Fig. 14c,d) of two-ply, S-spun, Z-twisted twine were recovered from Cache 1. The total length of the folded twine contained in the bundles is estimated to be in excess of 25 feet. Their specific use and relationship to the other artifacts found in the cache is not certain. This cordage appears to be made of yucca fiber thread, whereas most of the other two-ply specimens have threads made out of apocynum or a similar plant-stem material. A few specimens of two-ply, Z-spun, S-twisted cordage are present, but are definitely not well represented. Four-ply cords are rare at Exhausted Cave. Four specimens of this type cordage were found. They were fashioned by S-twisting two two-ply, S-spun, Z-twisted strands together. One of the four-ply cords was evidently used as a drawstring and is attached to the narrow end of a small rag weft bag (Fig. 16e) by an extended warp thread. This specimen and another, a possible binding loop, are only loosely and partially S-twisted on the final twist, thus exposing the paired strands for the most part. The other two cords have more tightly and completely twisted strands, which give them a braided appearance. These "false-braided" cords could be components of more complex objects such as skirts, which often incorporate four-ply cords as fringe material (Kent 1954:59; Specimen 49). One short section of a three-strand braided rope was constructed of bast fiber, probably Yucca elata. This specimen compares favorably with Specimen 48 from Montezuma Castle (Kent 1954:65).

Cotton cordage. As was the case with the cotton thread, a large quantity of the cotton cordage from Cache 2 is the same brownish-gray material found in the textile specimens. This two-ply, Z-spun, S-twisted cordage is believed to have been selvage material for the plain weave fabric. A few two-ply brown strings may have also served as selvage cordage. Three-ply cords of cotton are relatively scarce as are six-ply cords. These specimens, brown in appearance, are probably textile selvage material. Two examples of four-ply, Z-spun, S-twisted cord were recovered from Cache 2, and one specimen was associated with Cache 1 textiles. Another four-ply specimen from Cache 2 is a decorative multi-colored cord (Fig. 16f). It is formed in a similar manner to the "false-braided" bast cords. It differs from the former specimens by having a reverse pattern of four single-ply Z-spun threads twisted together to make the two two-ply, S-twisted yarns. One yarn has a brown and a white thread, and the other has a gray and a white thread. The yarns are united by Z-twisting to produce the cord, which, because of the colored threads,

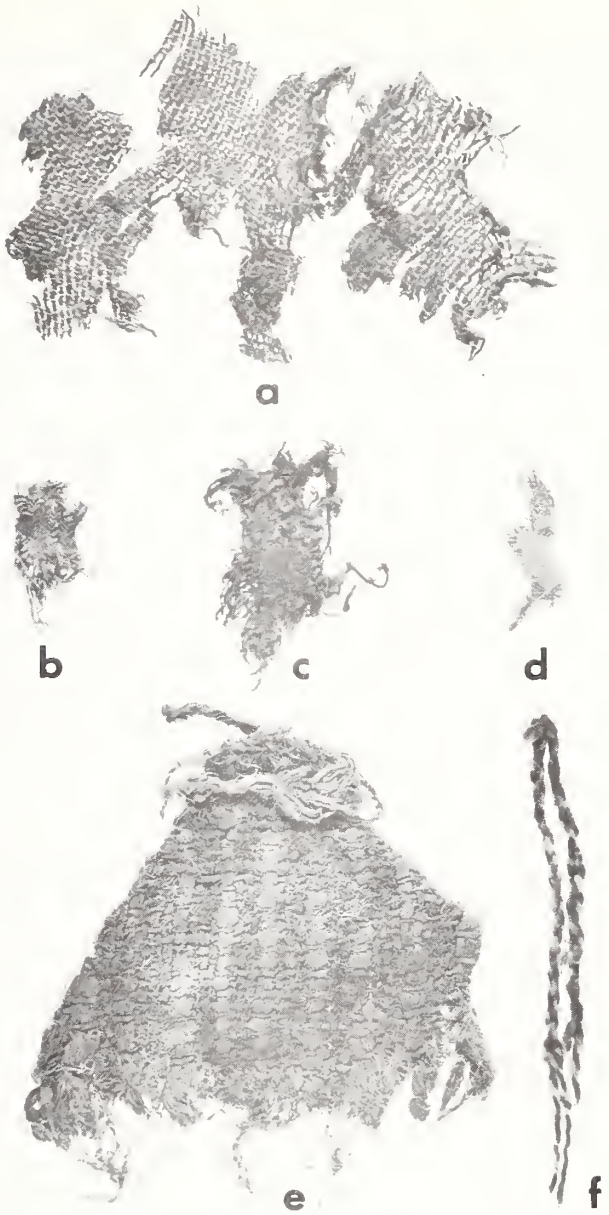

Figure 16. Textiles. a, Plain Weave Bast Fabric, Cache 1; b, Flat Braided Fabric; c and d, Plain Weave Cotton Fabrics; e, Rag Weft Bag; f, Cotton Cord. Length of e is 10 cm.

tends to emphasize the braided effect. Decorative cords from Kiet Siel and Montezuma Castle are thought by Kent (1957:605) to be necklace remains or ornamental ties. There is no evidence present with this specimen to support either of these proposed usages.

Textiles

The modest collection of bast and cotton textiles recovered from Exhausted Cave consists primarily of plain weave fabrics, including rag weft. Plaited or flat braided fabric is also represented.

Bast fabric, plain weave. A decomposed bag from Cache 1 has a plain weave fabric (Fig. 16a) made of light brown warps and dark brown wefts except for one small, inserted thread that is dyed blue. The threads are Z-spun with an average of 22 warp threads per inch and 17 weft threads per inch. The selvage is a two-ply, Z-spun, S-twisted cordage. The base material is thought to be a hard fiber derived from yucca or a similar type plant; the fineness of the individual fibers and softness of the fabric may, however, indicate otherwise. It is definitely a plant fiber other than cotton. The fabric constitutes only a part of the entire bag for one end of the object, presumably the closed end, was made of leather. The leather portion of the bag and the bag contents are described elsewhere under their individual headings and collectively in the section entitled Caches.

Cotton fabric, plain weave. Several small pieces of plain weave cotton fabric were recovered. The largest specimen is approximately 6 cm. long and 3 cm. wide. About half the specimens are S-twisted scraps of fabric which undoubtedly are associated with rag weft cloth. The twisted brownish-gray rags and specimens of brownish-gray fabric (Fig. 16c) from Cache 1 have an average of 25 warp threads and 22 weft threads per inch. Similar pieces from the rat's nest have 30 warp threads and 25 weft threads per inch. A brown plain weave fabric found in the rat's nest also has 30 warp and 25 weft threads per inch and is coated with an unknown crystalline substance. Another charcoal colored specimen from the rat's nest is a very finely woven fabric (Fig. 16d). It has a square count of 40 warps and 40 wefts per inch. Two brownish-gray specimens from the bench fill have square warp and weft counts of 35 and 25, respectively. There is also a piece of the coated brown fabric from the bench fill. All together, there are perhaps as many as six separate articles represented by these scraps, exclusive of the twisted rags which are probably related to a rag weft cloth such as that described below.

Rag weft fabric, modified plain weave. This artifact, illustrated in Figure 16e, appears to be some sort of bag. It was recovered from the prehistoric rat's nest and is seemingly complete. Loops, formed by doubling the rag wefts on themselves, are visible at the bottom of the cloth. They give the object its look of completeness because they are suggestive of selvage loops (Kent 1954:21, Fig. 6). As pictured, the bag is 10 cm. long and 12 cm. wide. These are also the approximate dimensions for the unfolded rectangular shape of the cloth. Two adjacent corners of the cloth were brought together to form the tapered end, just as one would do as a first step in constructing a paper airplane. A paired-thread, partially S-twisted drawstring was then slipped over the tapered end and attached to an extended warp thread to hold it in place. The fabric itself consists of S-spun bast threads and rag strips fashioned from a plain weave textile. The warps are single bast threads. The wefts are paired bast threads and rag strips. Three paired bast wefts occur between each of the rag wefts and the warp passes alternately over and under each set or pair of bast wefts and the rag weft. This pattern has been previously described as a half-basket plain weave (Kent 1957:496) when applied to either paired warps or paired wefts.

Cotton fabric, plaited weave. The plaited weave in this is a piece of a flat braided cotton fabric found in Cache 2 (Fig. 16b). The specimen is about 3 cm. long and 2 cm. wide. It has an off-white coloration. The weave is an over-three, under-three pattern of single-ply, S-spun cotton thread. There are 11 threads per centimeter in length and 8 threads per centimeter in width, on the average.

Chapter VI

CACHES

The previous descriptions of artifacts contained in the two caches have been largely technical, referring only to the relationships of these artifacts to the more general artifact categories under discussion. It seems logical at this time to proceed to attempt to integrate the various components of the two caches.

Cache 1

The discovery of Cache 1 came as somewhat of a surprise, for a gust of wind coming into the cave loosened the bundle from the face of the profile trench, causing the bag contents to spill on the cave floor.

Later excavations unearthed a portion of the bundle which had not fallen from its provenience. From the positioning of these artifacts, it was determined that the medicine bundle had been resting on top of Stratum IVb. There was no evidence of a pit outline; a large flat rock lying about 15 cm. above the bundle may, however, have been a cover for a pit.

This cache consists of a medicine bundle, so-called because its contents appear to be primarily of a ceremonial nature. The container is a leather and textile bag made of prairie dog skin (Fig. 13) and plain weave bast fabric (Fig. 16a). The skin, which has been mended on at least two occasions, formed the closed end of the bag. The bast fabric was attached to the skin with an adhesive which has been identified as pinyon pine pitch. The bag was found in such poor condition as to prevent taking any measurements or photographs of its entirety.

The only remotely comparable bag specimen that I know of comes from the collection recovered at Hidden House (Dixon 1956:16,17). The Hidden House bag is made of cotton and has three sections--the bottom section being a closed loop fabric, the center section a plain weave fabric, and the upper section a twill tapestry. The contents of this bag, or quiver as Kent (1957:555) calls it, were a bundle of sinew and a feather bundle.

The objects incorporated in the Exhausted Cave bundle include the contents of the bag container and some associated objects which were not definitely contained inside the bag. It is impossible to describe

the exact arrangement of each of the bundle components as they occurred inside or adjacent to the bag, due to the circumstances leading to the discovery of the cache.

Generally, it can be stated with some degree of certainty that the lithic artifacts (Fig. 8 and Fig. 9) were situated in the center or near the bottom of the bag. The various pouches, bundles, fringe, and twine were grouped together (Fig. 17) but not necessarily inside the bag. The turtle shell, antelope hooves, and clay mineral blocks were found near where the top of the bag had lain. The feather bundle may have been located beside the leather objects, but this is only a guess.

The implied usage of the lithic assemblage as a utilitarian wood, bone and fiber working tool kit does not necessarily preclude classifying it as ceremonial paraphernalia too. The near absence of bone artifacts at Exhausted Cave suggests that these tools were used more for wood and fiber work than for modifying bone. Ritual objects made of wood such as face masks, too large to be contained in the bundle, or woody plant materials, meant for consumption, may have been a factor for including wood working tools in the bundle. Since there was no evidence of ceremonial wooden artifacts found in the cave, this hypothesis can neither be proven nor disproven. The wrapped bundles on the other hand did contain herbaceous plant stems and roots. It is possible that the stone tools are in some way related to these materials. A special, functionally related set of tools may have been required for either procuring or preparing plant specimens for ritual acts. Wyman (1972a:145) notes in reference to the present-day Navajo Shootingway medicine bundle that various chipped stone implements have ". . . intimidatory and exorcistic properties, and are used to cut ceremonial materials . . . ."

It is further noted by Gould, Koster, and Sontz (1971:155) that among the Desert Aborigines there is an engraving tool called "pitjuru-pitjuru" within the broader class of "purpunpa" scraping tools that is considered sacred. It is used exclusively for decorating spear-throwers and sacred boards. Because of its sacredness, it is kept hidden in or near caches of ceremonial objects and is seldom used except just before or during ceremonies accompanied by myth songs as portrayed in the designs.

The next items of concern are the wrapped leather bundles (Fig. 14a, e). The wrapped bundles in the Exhausted Cave bundle both contained fragments of plant roots of the Umbelliferae family and one of these also had pungent smelling herbaceous Compositae stems in it. Here,

Figure 17. Bundle Grouping from Cache 1

too, it is possible to find modern analogy with Navajo materials. Wyman (1972b) mentions that small medicine bags in Evilway and Blessingway bundles contain odorous herbs used as chant lotion and emetic herbs used for the sweat-emetic ceremony.

The two leather pouches (Fig. 14b,f) from the cave both contain shredded plant material and pollen as well as other material. In the case of the sewn pouch, there are, in addition to hematite stain on the outside of the pouch, ponderosa pine pollen, oak pollen, plant fiber, a grass leaf, meal, and a cotton thread present. The other small pouch contains Cheno-Am and low-spine Compositae pollen, ground plant material and sandy soil. Mountain soil pouches from the Navajo Evilway and Blessingway bundles are comparable to these pouches. These Navajo soil pouches contain montane soil samples, pollen, meal, and other objects either from or representing places which are considered sacred. By analogy, it would then appear that the sewn pouch might represent, on the basis of the pine and oak pollen, the mountainous country above the Mogollon Rim and that the Cheno-Am and low-spine Compositae pollen represent the desert environment below the rim. The pollen and possibly the cornmeal could have been used for consecration and prayer in ceremonies related to these geographical areas.

Feather bundles are probably one of the most common elements of medicine bundles, both prehistoric and modern. These artifacts are reported with the Shootingway bundle, but their specific relationship with the rest of the medicine bundle is not discussed by Wyman (1972a:148). The feather bundle specimen occurring with the Exhausted Cave medicine bundle consists entirely of turkey feathers. No wrappings were visible, nor were there any individual pahos or ties represented.

Cordage such as that found in the Exhausted Cave bundle (Fig. 14c,d) also has a counterpart in the Navajo bundles. The latter bundles sometimes contain strings (Wyman 1972a:145) which are unraveled to symbolize warding off evil and danger.

The turtle shell rattle and antelope hooves (Fig. 12) are obviously musical instruments intended for use in chants. Hide rattles contained in the Navajo bundles were used for similar purposes (Wyman 1972a;b). The leather fringe associated with the Exhausted Cave bundle is probably a component of the turtle shell rattle. It may have been intended for attachment to the turtle shell and with the antelope hooves in turn tied onto the bottoms of the fringe as illustrated in Figure 12. This type rattle was common among modern

pueblo groups prior to replacement with gourd rattles (Underhill 1944: 125,126, Plate VI-1).

The only type artifact which is not represented in the Navajo bundles is the clay mineral blocks. These objects undoubtedly were used for their pigmentation. The brilliant red pigment is easily procured by merely wiping or touching the blocks. This could have been applied as a skin decoration or to color ceremonial objects.

All of the aforementioned articles are considered to be a complete medicine bundle owned by an individual and used to perform ceremonial functions. The repeated reference to Navajo medicine bundles is not intended to imply any relationship with that particular cultural group. The Navajo specimens have been well enough described to allow comparison and to make inferences concerning the components of the Exhausted Cave bundle, justifying dwelling on them to the above extent.

Cache 2

This cache was nearly overlooked during excavation. A ceiling chamber located above the bench had been sealed by inserting three overlapping stone slabs into the opening (Fig. 4d). This was then plastered over with a specially prepared mortar. Human hair and plant parts served as binding materials to give the mortar better adhesive properties for clinging to the cave roof. The mortar was blackened with soot and was practically indistinguishable in texture and color from the rest of the roof. A few seeds protruding from the clay and finger indentations gave evidence of the existence of the cache. Textiles, seed, and clay showered from the ceiling upon removing the stones.

The textiles found in a prehistoric rat's nest are believed to have been removed from this cache via a small hole in the roof which links up to the ceiling storage chamber. The majority of textile and cordage artifacts were recovered from these two proveniences. These have been described in detail in the section dealing with bast and cotton artifacts. Plain weave, rag weft, and flat braided cotton fabrics were represented. Bast and cotton cordage and rag strips were recovered from both locations.

The numerous seeds that occurred inside the cache and in the nest include corn, pumpkin, and cotton seed. Fruits of either gray thorn or buckthorn were also contained in the cache. These seeds were undoubtedly wrapped in cloth or otherwise stored in bags associated with the cache.

Plain weave bags containing squash seed for planting are reported from Canyon Creek Ruin and McEuen Cave (Kent 1957:625). This seems to me to be a practical and acceptable explanation of the purpose of seed caches and the Exhausted Cave seed cache probably served the same function.

The purpose of storing pieces of raw clay in the cache is unknown, but it may have something to do with controlling moisture or temperature. Deep storage pits dug into the subsoil at prehistoric Indian villages in the Kayenta Anasazi area seem to have been constructed for this purpose (Paul Fish, personal communication, 1975).

Chapter VII

TECHNOLOGIES

The following discussion of technologies serves as an interpretive review of the material culture of the occupants of Exhausted Cave. It is a summary of data and interpretation of the findings as they relate to subsistence and maintenance activities. Taxonomic classes of artifacts are grouped together as technological industries, each of which is treated separately in this chapter and integrated into a whole in the concluding chapter.

Chipped Stone Industry

The most noteworthy observation concerning the chipped stone industry is that the soft hammer percussion technique was used on a regular basis by these people in their tool making activities.

Projectile points and large bifacial implements made of flow basalt make up about 70 percent of the industry. The abundance of projectiles probably represents either intensive hunting activities or the presence of a flint knapper. The basalt implements imply use for collecting wild plant foods.

The usual knife and scraper categories are seemingly underrepresented in the collection, indicating the lack of need for retouched tools which are normally associated with hunting activities.

A fair quantity of perforators and drills indicates processing of non-subsistence related goods.

Knapping activities probably took place in the work area outside the cave as a high frequency of cortical flakes in that area indicates. The non-cortical flakes, both used and unused, were concentrated inside the cave in the bench area. These simple tools were probably the mainstay for carrying out cutting and scraping activities. Not all of the stone was meant for everyday use. An apparent wood working tool kit was part of a medicine bundle.

Ground Stone Industry

The metate fragments recovered from the cave indicate use in conjunction with one-hand manos and the manos that were recovered are mostly of the two-handed variety. This outward disparity is best

explained by the presence of specialized grinding areas in another locality of the ruins. The two-handed manos were probably carried back and forth to such an area, and lesser tasks requiring the use of smaller grinding implements were probably performed at the cave itself.

The presence of pounding and rubbing stones shows that plant foods and possibly animal products were processed within the cave.

Evidence of arrow manufacturing is provided by an arrow shaft abrader and two apparent nock files. Several hammerstones which vary a great deal in size and one or two pebble pounders provide additional documentation of knapping activity.

Numerous grinding stones showed evidence of pigment preparation. The quantity of such artifacts suggests the possibility that the cave may have been used at various times for ceremonial preparations.

A few crudely executed axes and stone cylinders reflect the low level of skill applied in the manufacture of ground stone artifacts.

The mineral collection is especially significant as it is indicative of a complex exchange network reaching all the way to Death Valley in southeast California. A plentiful supply of local minerals, such as salt, gypsum, and calcite, attests to the well developed mining technology of the local population. Various mineral salt deposits occur all along West Clear Creek.

Ceramic Industry

The discovery that the dominant decorated pottery was Tuzigoot White-on-red was unexpected, considering that all other excavated sites in the Verde only contained a few sherds of this type, at most. There is also a good possibility that Walnut Black-on-white pottery was locally produced, since it is the second ranking painted pottery type at the site and because of its continuance in abundance at Exhausted Cave and at other neighboring sites (Jackson and Van Valkenburgh 1954; Caywood and Spicer 1935) long after its decline in the Winslow area, its supposed center of manufacture (Gumerman and Skinner 1968). Other candidates for local manufacture include Kayenta pottery types (Dickie 1965; Paul Fish, personal communication). Winslow Orange Ware is yet another potentially local manifestation. Plain ware and decorated types of this pottery ware occur in significant enough amounts at Exhausted Cave to at least warrant consideration as indigenous types.

Bone Industry

There was so little bone recovered from Exhausted Cave that the only definite conclusion is that either bone working technology is nil or bone work was performed in some other area of the site and the artifacts did not filter into this particular cave.

Shell Industry

Here is a technological area where the occupants of Exhausted Cave excelled. Shell beads were found in various stages of manufacture throughout the cave deposits. Shell carving was not stressed by these people. There is even evidence of collecting fresh water species of clam and using their shells as decoration pieces. Narssarius shell beads distinguished this assemblage from most others. With over 200 pieces collected, it seems reasonable to assume that shell played a major role in the economic system of this culture.

Wood Industry

The evidence for wood work consists chiefly of hunting equipment and weaving tools. A possible digging stick and a problematical split wood object (paho?) complete this category.

Leather Industry

Various bags, pouches, and fringe bands were made of tanned leather. Some of these articles had wraps of narrow strips of leather wound about them to secure their contents safely inside. Sinew was used for sewing and patchwork on leather items. In one instance, a leather pouch was stained a brilliant red, probably from a hematite powder.

Textile Industry

The main characteristic of the Exhausted Cave textiles is the extensive use of bast fiber in their construction. Rag weft technology is probably the next most distinctive feature of the industry. Other techniques used for producing textiles include flat braiding in an over-three, under-three pattern and plain weaving or an over-one, under-one pattern. There were no decorative textiles found in the cave, but 4-ply cotton yarn was made up of gray, brown, and two white threads combined so that the paired threads when wound together had a braided appearance. Related woven articles include a plaited over-two, under-two sandal and a piece of plain woven matting.

Miscellaneous Perishables

Items such as feather bundles, antelope hooves, and a turtle shell rattle are specifically related to ceremonial activities. Objects like perforated gourds, stripped devil's claws, a grass coil, and ties of various sorts probably served utilitarian purposes. Other objects like a small wrapped beargrass bundle defy classification.

Chapter VIII

TRADE

Pottery

Not all of the classes or types of artifacts mentioned below are necessarily trade items. It has already been suggested that several pottery types usually considered as foreign to the Verde Valley may, in fact, have been locally made; thus, the technology rather than the actual material goods was spread over a specified area. Redistribution systems are yet another means for dispersing commodities and may be particularly significant for explaining exchanges of whole sets of artifacts. Actual migrations of peoples and seasonal transhumance habits are ways of moving entire assemblages of artifacts or select portions of them from one location to another and either pattern may go undetected when mixed with other assemblages.

Of the many classes of artifacts found in Exhausted Cave, the decorated pottery types are probably the best indicator of trade relations and so they will be discussed first.

Beginning with the more exotic pottery types, there are clues to possible cultural relationships. The single sherd of Santa Cruz Red-on-buff is undoubtedly intrusive to this site, and the complete absence of classic period Hohokam pottery types suggests a severance of the trade relations to the south which have been so evident in prior phases in the Verde Valley (Breternitz 1960). An early Mesa Verde sherd found in the cave is an unusual occurrence, but is not an entirely unique one. A similar contemporaneous situation reported at the Fitzmaurice Ruin (James 1974:124) suggests that a trace of Mesa Verde pottery might be expected to be present in the A.D. 1130 to 1320 ceramic assemblage, indicating trade relations with the Mesa Verde peoples.

Pottery from the Prescott area is represented by only a few scattered sherds, suggesting weak trade relations and probably mostly outgoing relations. The Cohonina culture, which is closely affiliated with the Prescott culture, is not represented at all in the ceramic assemblage at Exhausted Cave.

Northern Sinagua decorated pottery types of this period, notably Turkey Hill White-on-red and Sunset White-on-red, are missing from the Exhausted Cave assemblage. A few plain ware sherds of Sunset Red

and some decorated sherds of Elden Corrugated are the only possible link to the Northern Sinagua. Other than these pottery types, there is no way of distinguishing the northern pottery assemblage from the southern assemblage, since both areas receive similar trade pottery types from a common source(s).

Kayenta pottery is familiar to nearly all or all sites in the Verde Valley. Types of this ware attributed to manufacture in the Kayenta area occur in even the very early sites (Breternitz 1960). It should be noted, however, that Kayenta types were also being manufactured in the Winslow area from whence Little Colorado White Ware emerged (Gumerman and Skinner 1968). The co-occurrence of both Kayenta and Winslow pottery types at Exhausted Cave favors the notion of a co-tradition and suggests that they came from a common source.

The Little Colorado White Ware pottery tradition is most evident in the Winslow or central Little Colorado area. Gumerman and Skinner (1968:191) recognize close similarities between Holbrook Black-on-white and certain contemporaneous Kayenta types. They also view Walnut Black-on-white and Padre Black-on-white styles as introductions from the upper Little Colorado and White Mountain areas. The central Little Colorado would seem the most likely area for trade of this ware, although it is interesting that the type continues in importance at Exhausted Cave long after the A. D. 1250 date suggested for the abandonment of the central Little Colorado area (Gumerman and Skinner 1968:195). Sherds of Walnut Black-on-white persisted into the 17th century at Awatovi also (Smith 1971:251). More will be said of trade relations concerning this ware later on.

Trade with the Cibola area (Carlson 1970:1) is indicated by the presence of several pottery types of the Puerco-Chaco series and White Mountain Series of Cibola White Ware. Population movements of indigenous peoples in the Cibola area and Mesa Verde culture patterns found in that area during the 12th and 13th centuries (Vivian and Mathew 1973) probably bear an indirect relationship to pottery types found at Exhausted Cave. The western boundary which is the most likely location for exchange of this ware is near the Petrified Forest adjacent to the Winslow area.

Mogollon pottery types were not all that well identified or classified and are, therefore, best left out of the trade relations scheme, but keeping in mind their presence in the assemblage. The Winslow Orange Ware and Jeddito Yellow Ware pottery types are best known from the central Little Colorado area in the vicinity of the Homolovi,

Hopi, Puerco, and Chevelon Ruins. Elements of Tuwiuca Black-on-orange or Antelope Black-on-straw and Jeddito Black-on-orange are considered by Smith (1971:549) to coalesce into the type referred to in this report as Jeddito Black-on-yellow; although he would prefer calling this early Jeddito bichrome Awatovi Black-on-yellow, the choice of names has little to do with the relationship between the Winslow and Jeddito wares.

Pinedale Black-on-red and Pinedale Polychrome, described by Carlson (1970:109) as a combination of Tularosa and Kayenta-Hopi styles, indicate trade within an area between Roosevelt Lake and the headwaters of Silver Creek near Show Low, Arizona (Carlson 1970:51).

The indigenous Tuzigoot White-on-red and polychrome pottery types are not known to have been traded beyond the Verde Valley; the scrolls, scalloped lines, ticked lines, hooked and barbed lines, and dots in zonal layouts, however, suggest strong relationships with the Salado pottery types. Similarities in vessel shapes further strengthen this stylistic-technological relationship. The dominance of decorated red pottery at Exhausted Cave may indicate a pattern which is carried over to the Salado pottery tradition.

Textiles

The textiles from Exhausted Cave referred to earlier in this report include examples of rag weft, flat braiding, and plain weaving techniques. The distribution of rag wefts is quite limited. Kent (1957:500) reports this type of cloth from Montezuma Castle, Honanki, Palatki, Tonto National Monument, Canyon Creek, and other Verde Valley sites. Flat braided textiles of the type found at Exhausted Cave are recorded from Montezuma Castle, Tonto National Monument, and Mule Creek Cave (Kent 1957:593). Plain weave fabrics are, of course, widespread; the use of mainly bast threads in Pueblo III textiles, however, is restricted more or less to the Verde Valley, Sierra Ancha, and Mogollon territories (Kent 1957:500). Haury (1934:87) reports that bast is the favored material used in the manufacture of textiles at Canyon Creek Ruin. Sinagua-Salado textile affiliations are said by Kent (1957:642) to originate from Mogollon-Pueblo or Hohokam traditions.

Another weaving technique demonstrating these southern affiliations is found in the construction of sandals. Plaited sandals woven in an under-two, over-two pattern are reported from Montezuma Castle (Kent 1954:51), Rarick Creek, Clear Creek, Tonto National Monument, and Canyon Creek Ruin (Haury 1934:65,66), and from Kinisba (Cummings 1940:69).

Minerals

Minerals are probably the most important natural resources used in trade by the occupants of Exhausted Cave. Salt, calcite, and gypsum are all products easily obtained from the immediate environment. In fact, these and other mineral salt deposits can be seen from the cave. Other minerals from the vicinity of the Verde Valley include copper ores and their derivatives, argillite and volcanic minerals. Since most of these minerals can also be found in other localities, it would be impossible to state for certain that any one occurrence is attributable to trade with this particular site or even to the Verde population. There is one instance where Haury believes that salt found at the Canyon Creek Ruin may have come from the salt mine near Camp Verde (1934:59,60). A few rare earth minerals from Death Valley and possibly gilsonite from the California desert region suggest distant trade relations to the west, which is in part supported by an isolated find of Jeddito Black-on-yellow pottery in the Mohave Desert (Jennings 1956:107).

Shell

The large quantities of California shell that were recovered from Exhausted Cave suggest continued trade relations with the Hohokam to the south. Presumably, the Hohokam ventured as far west as Los Angeles, California (Jennings 1956:106), but as implied concerning mineral trade (Jennings 1956:107), there may have been peoples other than the Hohokam trading to the far west.

Other Artifacts

Most of the chipped stone, ground stone, and perishable artifacts are standard subsistence items and are not diagnostic of any particular culture or area. Very few reports for this time period have gone into enough detail in describing such artifacts to make it possible to compare such things as their manufacturing technologies. For instance, the distribution of the soft hammer percussion technique has not been discussed for any other archeological site of this time period. Wooden artifacts such as spindle whorls are common in southern sites, but do occur in northern sites as well (Kent 1957:473). Thus, there exists a number of technological parallels related to subsistence artifacts which could probably be compared profitably within ecological zones, but which have not been adequately described in the literature.

Chapter IX

SUMMARY AND DISCUSSION

The purpose of this final chapter is to summarize and discuss ways in which the occupants of Exhausted Cave interacted with their natural and cultural environments and to integrate these findings with existing theories concerning the prehistoric Sinagua culture.

An examination of the ways in which the cave occupants interacted with their natural environment was taken up in the chapter on technologies in which it was suggested that there was specialization of economic task performances and that this gave evidence of the structure of the economy.

Specialization was evident due to the quantities or lack thereof of certain artifact types considered indicative of particular subsistence and maintenance activities. The evidence for specialization in most instances was obviously directed at community activities. A case in hand is that there are strong indications that a flint knapper occupied the cave during the Tuzigoot Phase and that he manufactured a large quantity of projectile points. Evidence for game processing activities was practically non-existent in the cave, which suggests a community redistribution system where the projectiles were outflow items and already processed game may have been an inflow item.

On a larger scale, some resources such as minerals may have been controlled by the Clear Creek community and used in exchange for goods brought in from distant communities.

The Exhausted Cave artifact assemblage, as a whole, is highly suggestive of a complex redistributive type of economy, dependent upon a well organized society. The ceremonial artifacts that occur in the assemblage indicate that there was a strong community or intercommu social bond present.

The pattern shown above indicates that the subsistence-maintenance relationship with the natural environment satisfied communal and probably intercommunal socio-economic as well as physical needs of the occupants of the cave.

The artifact distribution data for non-ceramic materials--on file at the Museum of Northern Arizona--suggests that the observations mad

above are characteristic only of the Tuzigoot Phase. It seems that the cave may have been used only intermittently during the Honanki Phase, as a temporary shelter and storage area, so that it cannot be considered as representative of the Clear Creek community for the period from A. D. 1130 to 1275 or 1300.

The analysis of trade patterns at Exhausted Cave shows that affiliations were primarily with the central Little Colorado region during the Honanki Phase and that this trade pattern continued into the Tuzigoot Phase without any noticeable changes, until near the time the cave was abandoned, when there appear to have been noticeable relationships with the Sierra Ancha or Tonto areas to the southeast. The evidence for these trade relationships comes mostly from intrusive pottery wares, which are, themselves, complexly related.

The combination of trade wares found at Exhausted Cave represents a pottery tradition that developed in the central Little Colorado region. At about A. D. 1070 or slightly before, there was a breakdown along the Chevelon Creek cultural frontier, which had, since Basketmaker III times (Gumerman and Skinner 1968:188), separated the Mogollon-Cibola Anasazi occupying the region south of the Little Colorado River and north of the Mogollon Rim from the Sinagua and Winslow area Kayenta Anasazi cultures. When this frontier collapsed, there were strong interactions among these three cultures. This can be seen in their respective pottery assemblages. The development of Little Colorado White Ware from Kayenta and Mogollon-Cibola ceramic types started a new ceramic tradition, the central Little Colorado tradition, which spread rapidly throughout the Sinagua region, which was formerly affiliated by trade with only the Kayenta Anasazi and Hohokam cultures. Pottery from the Cibola region also filtered into Sinagua sites. A vestige of Mesa Verde pottery was introduced with Cibola pottery, reflecting on-going relationships between the two cultures.

By A. D. 1250, pre-existing villages which had been fairly widely distributed in the central Little Colorado and Sinagua regions began to coalesce even more, tending to locate near permanent water supplies, as along rivers and springs (Colton 1946; Gumerman and Skinner 1968; Wilson 1969). Sites affiliated by trade during this period include the Homolovi, Awatovi, Chevelon, and Puerco Ruins in the central Little Colorado area; the Old Caves Pueblo and a group of sites situated near Anderson Mesa in the Northern Sinagua area; the Clear Creek Ruins, Montezuma Castle, and Tuzigoot National Monument in the Verde Valley.

Walnut Black-on-white pottery, beginning at about A.D. 1100, continued in abundance at these large sites; and several new pottery types, notably Winslow Orange Ware and late Cibola White Ware types in the White Mountain series, made their appearance. These latter types strongly influenced the development of many new polychrome pottery types and Winslow Orange Ware played a leading role in the development of Jeddito Black-on-yellow pottery. At about A.D. 1300, the pattern was fixed; the Exhausted Cave and Clear Creek Ruins group may, however, have begun to deviate from the pattern by producing their own distinct decorated pottery. With the impetus of influence from the Pinedale area in the Mogollon-Anasazi regions as indicated by the Tularosa and Pinedale pottery types, a new horizon may have opened to the Southern Sinagua. When Exhausted Cave was finally abandoned about A.D. 1320, there is good evidence from their local pottery tradition and from their textile tradition that the affiliation pattern had shifted to a more southerly direction, pointing to the Sierra Ancha and Tonto Basin areas where Southern Sinagua influence was helping shape the Salado culture.

The inter-regional trade pattern indicates economic affiliations among the occupants of Exhausted Cave, other Southern and Northern Sinagua sites, the central Little Colorado region, and possibly with the Salado region.

This discussion has thus far indicated that there is a definable primary interaction sphere that focuses on the central Little Colorado region and in which the Clear Creek residents operated. It has further implied that interaction took place mainly through a redistribution type of economy and that the economic structure was maintained by ceremonial reinforcement.

The next question then concerns how these findings fit existing ideas of Sinagua relationships.

To begin with, there is no evidence from the present study to indicate that there was any mass movement of Northern Sinagua populations into the Verde Valley around A.D. 1125 as Colton (1946) and Breternitz (1960) postulated. Influence at this period in time came from the central Little Colorado area. Also, there are no indications that Hohokam traits and affiliations were retained after this date, which indicates some agreement with Colton's and Breternitz' ideas.

Colton's (1946; 1960) theories concerning movement into the Sinagua area following the eruption of Sunset Crater seem to be at least partially correct; but, instead of Kayenta Anasazi, Mogollon, and

Hohokam peoples coming in from their respective regions, there appears to have been Mogollon-Cibola influence which entered and effected change in the central Little Colorado area; and this new central Little Colorado pattern subsequently spread in several directions at once to cover the entire Sinagua region.

On the regional scene, there seems to be evidence to indicate that neither Schroeder's nor Reed's and Johnson's theories are entirely correct, or for that matter, entirely incorrect.

Schroeder's (1953) idea of Hohokam peoples residing alongside the Kayenta Anasazi in the Sinagua region seems reasonable enough, except that there is no reason to assume that other peoples were actually residing within the Sinagua region. His thoughts of a post A.D. 1120 Northern Sinagua Kayenta-Mogollon-Hohokam pattern moving into the Verde is similar to Colton's concept and is subject to the same criticisms. The idea of a Southern Sinagua pattern movement into the Tonto and Gila Basins, expressed by Schroeder, is more compatible with the data, providing the pattern is that which developed in the central Little Colorado region.

The concept of a Western Pueblo inter-regional tradition as defined by Reed (1942) and modified by Johnson (1965) appears to be beyond the findings of this analysis.

In summation, two approaches involving the theory of cultural ecology were used to examine the interrelationships of the Exhausted Cave group with other cultural groups and with their natural environment. An economic redistribution system was evidenced to affect these relationships. Continued research in this direction is necessary to confirm this hypothesis concerning a redistribution economy and to better understand just how it functioned; although this study represents quite a departure from most Sinagua studies, it is felt that the concept of cultural ecology can be a very useful tool in explaining relationships and changes in Sinagua cultural patterns.

REFERENCES

Allen, A. M.
1937 Sequence of Human Occupancy in the Middle Rio Verde Valley, Arizona, Ph. D. dissertation, Clark University, Worchester.

Atwell, W. G.
1934 Proposed Research Monument Number One, Clear Creek, Ariz; Clear Creek Ruins. U. S. Department of Interior, National Park Service.

Barnett, F.
1974 Excavation of Main Pueblo at Fitzmaurice Ruin. Museum of Northern Arizona Special Publication. Flagstaff.

Breternitz, D. A.
1958 The Calkins Ranch Site, NA2385-Preliminary Report. Plateau 31 (1):19-20.

1960 Excavations at Three Sites in the Verde Valley, Arizona. Museum of Northern Arizona Bulletin 34. Flagstaff.

1966 An Appraisal of Tree-Ring Dated Pottery in the Southwest. Anthropological Papers of the University of Arizona, No. 10, Tucson.

Britton, N. L.
1889 A List of Plants Collected at Fort Verde and Vicinity and in the Mogollon and San Francisco Mountains, Arizona, 1884-1888, by Dr. E. A. Mearns, U. S. A. In Transactions of the New York Academy of Sciences.

Carlson, R. L.
1970 White Mountain Redware: A Pottery Tradition of East-central Arizona and Western New Mexico. University of Arizona Press, Tucson.

Caywood, L. R. and E. H. Spicer
1935 Tuzigoot, The Excavation and Repair of a Ruin on the Verde River near Clarkdale, Arizona. Field Division of Education, National Park Service, Berkeley.

Childe, V. G.
1949 Neolithic House-types in Temperate Europe. Proceedings of the Prehistoric Society 15:77-86.

Clark, A.
1963 An Analysis of the Shrubs, Trees, and Cacti in the Plant Population of the Montezuma Well Rim. Unpublished manuscript of preliminary report on file at Montezuma Castle National Monument, Camp Verde, Arizona.

Colton, H.S.
1932 Sunset Crater: The Effect of a Volcanic Eruption on an Ancient Pueblo People. Geographical Review. October, 582-900.

1939 Prehistoric Cultural Units and Their Relationships in Northern Arizona. Museum of Northern Arizona Bulletin 17, Flagstaff.

1946 The Sinagua: A Summary of the Archaeology of the Region of Flagstaff, Arizona. Museum of Northern Arizona Bulletin 22, Flagstaff.

1955 Checklist of Southwestern Pottery Types. Museum of Northern Arizona Ceramic Series 2. Flagstaff.

1956 Pottery Types of the Southwest: Wares 5A, 5B, 6A, 6B, 7A, 7B, 7C, San Juan Red Ware, Tsegi Orange Ware, Homolovi Orange Ware, Winslow Orange Ware, Awatovi Yellow Ware, Jeddito Yellow, Sichomovi Red Ware. Museum of Northern Arizona Ceramic Series 3C. Flagstaff.

1958 Pottery Types of the Southwest. Museum of Northern Arizona Ceramic Series 3D. Flagstaff.

1960 Black Sand: Prehistory in Northern Arizona. University of New Mexico Press, Albuquerque.

Colton, H.S. and L.L. Hargrave
1937 Handbook of Northern Arizona Pottery Wares. Museum of Northern Arizona Bulletin 11. Flagstaff.

Crabtree, D.E.
1972 An Introduction to Flintworking. Occasional Papers of the Idaho State University Museum 28. Pocatello.

Cummings, B.
1940 Kinishba: A Prehistoric Pueblo of the Great Pueblo Period. Hohokam Museums Association and the University of Arizona, Tucson.

Dickie, R. T.
1965 A Study of Physical and Chemical Methods of Archaeological Data Retrieval. M.A. Thesis, Department of Anthropology, Arizona State University, Tempe.

Dixon, K.A.
1956 Hidden House, A Cliff Ruin in Sycamore Canyon, Central, Arizona. Museum of Northern Arizona Bulletin 29. Flagstaff.

Edwards, E.
1942 Pueblo IV in the Middle Verde Valley. Unpublished manuscript on file at Arizona State Teachers College (Northern Arizona University), Flagstaff.

Fewkes, J.W.
1898 Archaeological Expedition to Arizona in 1895. Seventeenth Annual Report of the Bureau of American Ethnology, Part 2. pp. 519-744. Washington.

1912 Antiquities of the Upper Verde River and Walnut Creek Valleys, Arizona. Twenty-eighth Annual Report of the Bureau of American Ethnology. pp. 185-200. Washington.

Fish, P.R. and G. Whiffen
1967 The Excavation of an Early Pueblo III Site near Perkinsville, Arizona. Unpublished manuscript on file at the Museum of Northern Arizona, Flagstaff.

Gladwin, W. and H.S. Gladwin
1930a An Archaeological Survey of the Verde Valley. Medallion Papers 6. Gila Pueblo, Globe.

1930b Western Range of the Red on Buff Culture. Medallion Papers 5. Gila Pueblo, Globe.

Gould, R.A., D.A. Koster, and A.H.L. Sontz
1971 The Lithic Assemblage of the Western Desert Aborigines of Australia. American Antiquity 36(2):149-69.

Green, C. and W.D. Sellers
1964 Arizona Climate. University of Arizona Press, Tucson.

Gumerman, G.J. and S.A. Skinner
1968 A Synthesis of the Prehistory of the Central Little Colorado Valley, Arizona. American Antiquity 33 (2):185-99.

Haury, E. W.
1934 The Canyon Creek Ruin and the Cliff Dwellings of the Sierra Ancha. Medallion Papers 14. Gila Pueblo, Globe.

1950 The Stratigraphy and Archaeology of Ventana Cave. University of New Mexico Press and University of Arizona Press, Albuquerque and Tucson.

Jackson, E.
1933 A Survey of the Verde Drainage. M.S. Thesis. University of Arizona, Tucson.

Jackson, E. and S. P. van Valkenburgh
1954 Montezuma Castle Archeology, Part 1: Excavations. Southwestern Monuments Association Technical Series 3(1). Globe.

James, K. G.
1974 Ceramic Analysis. In Excavation of Main Pueblo at Fitzmaurice Ruin, by F. Barnett. Museum of Northern Arizona Special Publication. Flagstaff.

Jennings, J. D.
1956 The American Southwest: A Problem in Cultural Isolation. In Seminars in Archaeology, 1955, edited by R. Wanchope. Memoirs of the Society for American Archaeology 11:59-127. Salt Lake City.

Johnson, A. E.
1965 The Development of Western Pueblo Culture. Ph. D. dissertation, University of Arizona, Tucson.

Kent, K. P.
1954 Montezuma Castle Archeology, Part 2: Textiles. Southwestern Monuments Association Technical Series 3(2). Globe.

1957 The Cultivation and Weaving of Cotton in the Prehistoric Southwestern United States. Transactions of the American Philosophical Society 47(3). Philadelphia.

Kidder, A. V.
1966 An Introduction to the Study of Southwestern Archaeology with a Preliminary Account of the Excavations at Pecos. Yale University Press. New Haven.

King, C.R.
1933 Notes on Hidden House on file in the Anthropology Department, University of Arizona, Tucson.

Lowe, C.H.
1964 Arizona Landscapes and Habitats. In The Vertebrates of Arizona, edited by C.H. Lowe. pp. 1-132: University of Arizona Press, Tucson.

McDougall, W.B. and H.S. Haskell
1960 Seed Plants of Montezuma Castle National Monument. Museum of Northern Arizona Bulletin 35. Flagstaff.

Mearns, E.A.
1890 Ancient Dwellings of the Rio Verde Valley. The Popular Science Monthly 37(6):745-63.

McGregor, J.C.
1941 Winona and Ridge Ruin, Part I. Museum of Northern Arizona Bulletin 18. Flagstaff.

Mindeleff, Cosmos
1896 Aboriginal Remains in Verde Valley, Arizona. Thirteenth Annual Report of the Bureau of American Ethnology. pp. 185-261. Washington.

Morris, E.
1928 An Aboriginal Salt Mine at Camp Verde, Arizona. American Museum of Natural History Anthropological Papers 30, Part 3. New York.

Olson, A. (ed.)
1959 Cibola White Ware Conference, 1958. Museum of Northern Arizona, Flagstaff.

Pierson, L.
1955 The Archaeology of Richards Caves, Arizona. Plateau 24(4):91-97.

1956 The Archaeology of Richards Caves, Arizona. Plateau 28(4):91-97.

1959 The Winneman Ranch Site, Central Arizona. El Palacio 66(4):128-39.

Reed, E. K.
1942 Implications of the Mogollon Concept. American Antiquity 8(1):27-31.

1950 Eastern-central Arizona Archaeology in Relation to the Western Pueblos. Southwestern Journal of Anthropology 6(2):120-38.

Sahlins, M. S.
1968 Culture and Environment: The Study of Cultural Ecology. In Theory in Anthropology, edited by R. A. Manners and D. Kaplan. Aldine Publishing Co., Chicago. pp. 367-73.

Schroeder, A. H.
1949 A Preliminary Examination of the Sacred Mountain Ball Court. Plateau 22(4):55-57.

1953 The Problem of Hohokam, Sinagua and Salado Relations in Southern Arizona. Plateau 26(2):75-83.

1957 The Hakataya Cultural Tradition. American Antiquity 23(2), Part 1: 176-78.

Schroeder, A. H. and Noteman
1946 Field notes on excavation of Clear Creek Ruin, NA2806, on file at the Museum of Northern Arizona, Flagstaff.

Semenov, S. A.
1970 Prehistoric Technology. Adams and Dart. Bath, Somerset, England.

Shutler, R., Jr.
1950 The Dry Creek Site. Plateau 23(1):6-10.

Smith, W.
1971 Painted Ceramics of the Western Mound at Awatovi. Peabody Museum Reports of the Awatovi Expedition 8. Cambridge.

Spicer, E. H. and L. R. Caywood
1936 Two Pueblo Ruins in West Central Arizona, Part I: King's Ruin. University of Arizona Bulletin 7(1), Social Science Bulletin 10:5-85. Tucson.

Taylor, W.P. and H.H.T. Jackson
1916 Biological Survey Reports, Verde Valley, 1916. Unpublished manuscript on file at Montezuma Castle, Camp Verde, Arizona.

Underhill, R.
1944 Pueblo Crafts. United States Department of the Interior, Bureau of Indian Affairs, Branch of Education, Washington, D.C.

Vivian, G. and T.W. Mathews
1973 Kin Kletso, a Pueblo III Community in Chaco Canyon, New Mexico. Southwest Parks and Monuments Association Technical Series 6, Part 1. Globe.

Wasley, W.W.
1957 Highway Salvage Archaeology by the Arizona State Museum, 1956-57. Kiva 23(2):17-19. Tucson.

Wilmsen, E.N.
1968 Paleo-Indian Site Utilization. In Anthropological Archaeology in the Americas, edited by B.J. Meggers. pp. 22-40. Washington Anthropological Society. Washington.

Wilson, J.P.
1969 The Sinagua and Their Neighbors. Ph.D. dissertation, Harvard University, Cambridge.

Woodbury, R.B.
1954 Prehistoric Stone Implements of Northeastern Arizona. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University 34. Cambridge.

Wyman, L.C.
1972a A Navajo Medicine Bundle for Shootingway. Plateau 44(4): 131-49.

1972b Navajo Ceremonial Equipment in the Museum of Northern Arizona. Plateau 45(1):17-30.

Young, J.N.
1973 Prehistoric Arrow Nock Files from Canyon de Chelly. Plateau 45(3):114-116.